AMATEUR WORK

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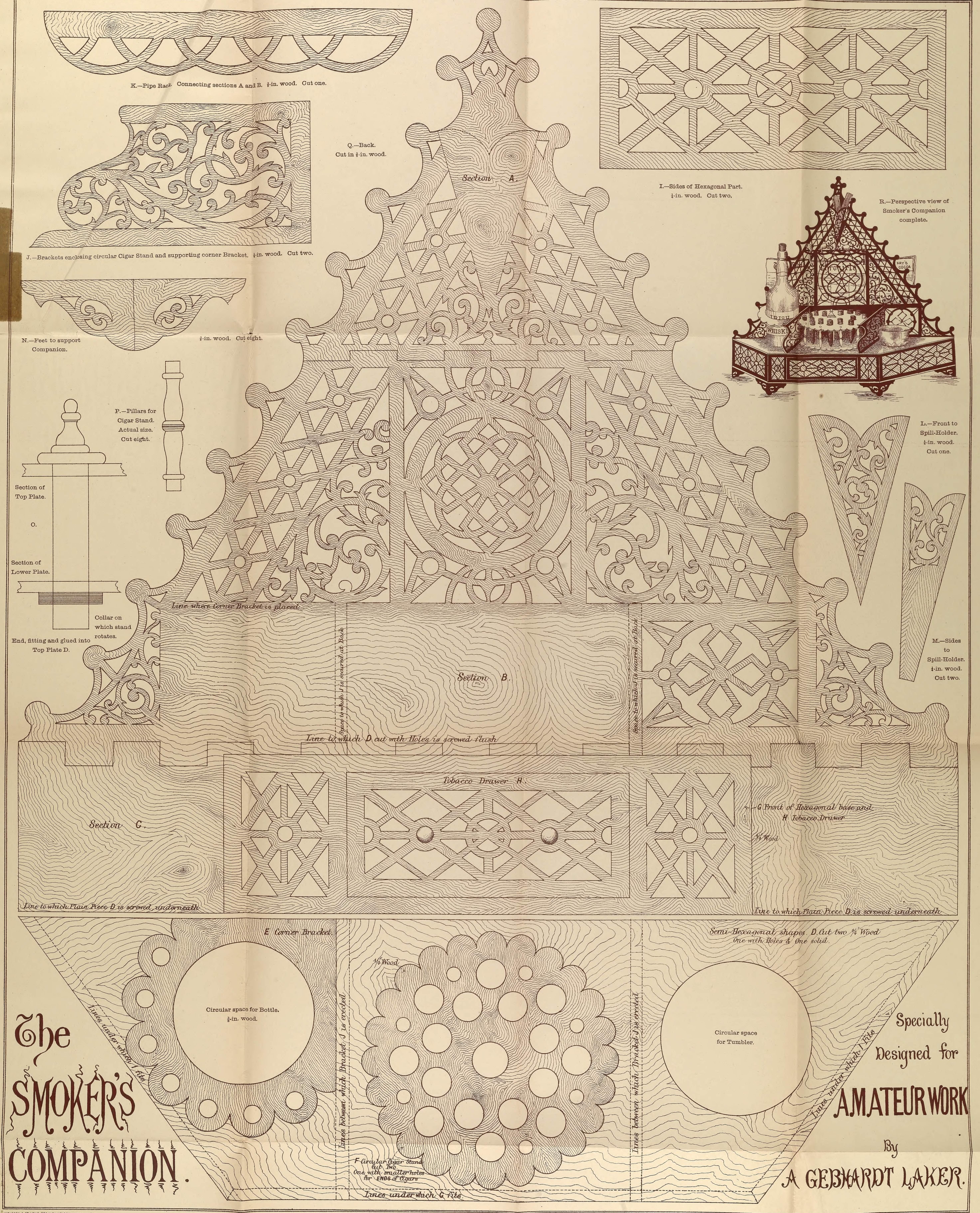

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AMATEUR WORK,

ILLUSTRATED.

EDITED BY THE AUTHOR OF

"EVERY MAN HIS OWN MECHANIC."

WITH SUPPLEMENTS,

Containing Designs and Working Drawings to Scale,

For Various Pieces of Work, Useful and Ornamental.

AND

SEVERAL HUNDRED DIAGRAMS AND ENGRAVINGS ON WOOD.

VOLUME VI.

London:

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AMATEUR WORK, ILLUSTRATED.

THE PRAXINOSCOPE: HOW TO MAKE IT.

By PROFESSOR L. MARISSIAUX.

MANY of my fellow-readers have doubtless already seen what is scientifically called a Thaumatrope (Greek, *θαυμα*, marvel, prodigy, and, *τροπή*, turn, revolution). The luminous impressions received by the eye, especially when they are very bright, persist during a certain time on the retina, which transmits them to the brain, even when it does not receive them any longer. A good many phenomena may be accounted for by this fact: the circle of fire described by a glowing lucifer with which a child is amused, the luminous track of a shooting star, the invisibility of a cannon-ball which passes before our eyes, the spokes of a quickly-revolving wheel becoming almost invisible too; all these are nothing but Thaumatropes, and the illusion takes place because the image of the objects placed behind these swift bodies persists during the short eclipse, so to speak, which the quick passage of the said bodies has caused them to undergo. As a counterpart to what has just been stated, very quick bodies may be seen motionless, as, for instance the cogs of a speedily-revolving wheel, if we can see them only during a very short time, by the light of an electric spark. Fig. 1 is a very simple Thaumatrope; it is a piece of white cardboard with a piece of string at each end; on one side are drawn parts or bits of a word, and on the other the missing parts. If you take the two bits of string between finger and thumb, and whirl the piece of cardboard very rapidly, the bits of letters traced on each side will seem to join, and will permit to read the whole word. Figs. 2 and 3 represent another: on one side is a cage, on the other a bird; if the Thaumatrope be whirled at great speed, the bird will seem to be in the cage, because the two images get on one another to form only one. The Phenakistiscope (Greek, *φεναχιστιχως*, deceiving, and *σχοπέιν*, to show) (Fig. 4) consists of two discs of metal, wood, or cardboard, of any convenient dimensions; one of them is provided with six narrow loop-holes, if I may call them so; the other disc placed behind, carries the image of any living being in the sundry positions of some action or other. If a rotary motion be given to the second disc, and if one looks through the narrow chinks of the front disc, the image seems to be animated. But this is a very awkward instrument, and the pleasure derived from it does not make up for the bother of setting it in motion.

FIG. 2.

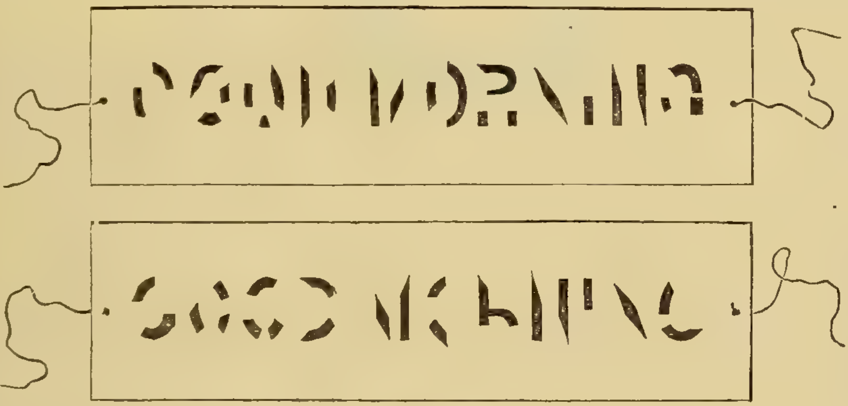


FIG. 1.

FIGS. 1, 2, 3.—SIMPLE FORMS OF THE THAUMATROPE.

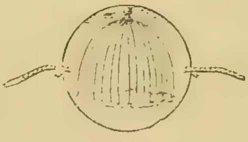


FIG. 3.

The next improvement brought to it is knowr under the name of Zoetrope (Greek *ζωή*, life, or *ζῶον*, living being, and *τροπή*, turn). The improvement was indeed very great, as may be seen in Fig. 5. Here the

whole thing is resting on a stand, and is easily handled about and easily set turning; but we still have the narrow loopholes, so fatiguing for the eyes on account of the continual passage of the rays of light before them. The pictures are placed under the loopholes and are looked at from the opposite side; but there is one great defect in the instrument thus contrived: the eye perceives more than one picture at a time. Let us suppose it is a motion with progress forward, as, for instance, in a picture representing a boy turning on his hands and feet like a wheel, or a trotting horse; it does not matter in this particular case, because it is not, after all, very unpleasant to see several images as though several boys were running in the aforesaid and unusual way one after the other, or several horses trotting in a row; but if the motion is, so to say, strictly *localized*, without any movement backward or forward, if it is, as we would say in French, a *mouvement sur place*, then it is another matter altogether: it takes off a great deal of the illusion if you see three or four images about the right one, especially when those images are always less neat and distinct than the one which stands right opposite the eye.

Let us now come to the last improvement of the Zoetrope; I mean the Praxinoscope (Greek, πραξις, action, and σχοπεῖν, to show). The theory of this very pretty and interesting toy for young and old is the following, which I take from M. Tissandier's magazine, *La Nature*:—

"Let A B be a plane mirror (Fig. 16) placed at a certain distance from a picture C D; the reflected image will be in C′ D′. Round the point O, middle point between C′ D′ as a centre, let us cause the mirror and picture to revolve together. Let B E and D F be their new position; the reflected image will be in C″ D″. The axis O has not moved. In the position occupied, before the first movement, by the mirror and picture, let us place another mirror and picture, the eye looking from M. Half the first picture will be seen in O D′ and half the second in O C′. If we continue the rotary motion we shall soon have the second mirror and picture in T T′ and S S′ respectively. At this moment the image of the second picture will be seen in whole in C‴ D‴, and soon after the second mirror and picture will be in B E and D F. Let us then imagine another mirror and picture taking the place of the first one, and the same successive phenomena will take place again. It follows from this that a series of pictures turning at a certain distance of, and round, the centre of a regular polygon will be seen successively at its centre, if plane mirrors be interposed on a concentric polygon just half-way between the centre of the polygon and the pictures. From what has just been said, we may see that the measures hereafter given may be at leisure increased or lessened as long as the principle and proportions remain the same."

The Praxinoscope* consists, as the Zoetrope, of a cylindrical case revolving on a stand; but in the middle of the case is erected a fourteen-sided polygon, whose sides are made of fourteen pieces of looking glass, in which the pictures are reflected. Of course, in the Praxinoscope the loopholes, or little windows, are done away with. I will now give a detailed description of this scientific toy so as to enable those of our amateurs who would try their skill and make one.

The first piece to be made, and the one that requires more care, is seen in Fig. 6. It is composed of a *straight* rod of iron A, $5\frac{1}{2}$ inches long and about $\frac{3}{8}$ inch in diameter, riveted *perpendicularly* in the plate B, which may be made of good sheet-iron $\frac{1}{8}$ inch thick or a little less, and 6 inches square (it may be made round, with a diameter of equal length or thereabout). This being ready, get two square (or round) pieces of wood—oak will do beautifully. The first one, 1 inch thick and *perfectly* flat, is 8 inches square. In the middle of it carve out a square (or round) hollow for piece B to fit in (see A, Fig. 7). This hollow must be just as deep as piece B is thick; the bottom of it must also be perfectly even, or else the rod A (Fig. 6) will not be perpendicular to board A; and this perpendicularity is extremely important, as will be seen further on. It would, perhaps, be better to avoid the tiresome work of carving out a hollow place in board A, to make it of two different pieces glued together; the wood of the top one must then have the same thickness as plate B (Fig. 6). The second piece, B (Fig. 7) is a little board $\frac{1}{4}$ inch thick and $7\frac{1}{2}$ inches square. It is provided in its centre with a small round hole of the same diameter as rod A. If board B is now fitted on A, either by gluing it on or by means of a few small screws, we have a stand for our Praxinoscope. Let me insist on the exact construction of this piece because if badly made, it will be useless to try to make it do, it *cannot* do: the rod A must by all means be exactly perpendicular to board A and its fitting piece B.

Let us now begin our case. Fig. 8 gives its shape. It is made of ordinary sheet zinc or tin, or even card-board; but I should not advise anyone to make it of the last-named material, as it would hardly be firm

* It is understood between M. Reynaud, the inventor of the Praxinoscope (18, *Rue Rodier, Paris*) and myself, that the right of making this instrument, for personal use, is given *only* to the readers of AMATEUR WORK Illustrated. The Praxinoscope being patented in England, M. Reynaud is protected by the law against those who would try to make it for commercial purposes. L. M.

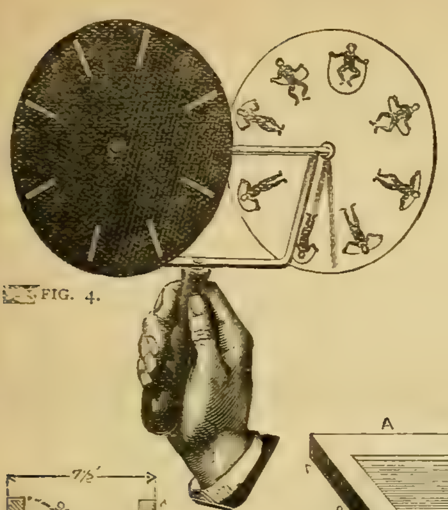


FIG. 4.

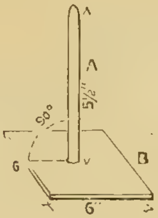


FIG. 6.

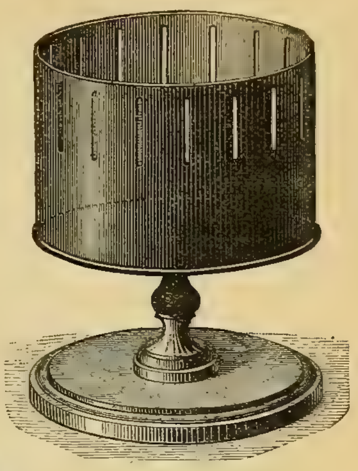


FIG. 5.

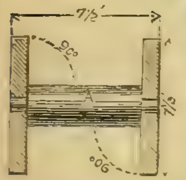


FIG. 12.

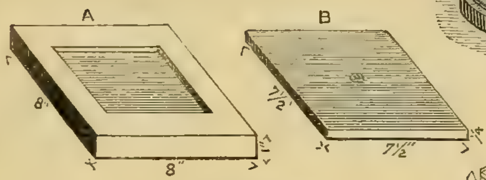


FIG. 7.

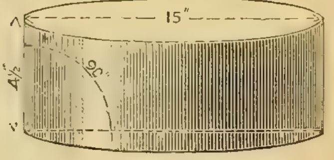


FIG. 8.

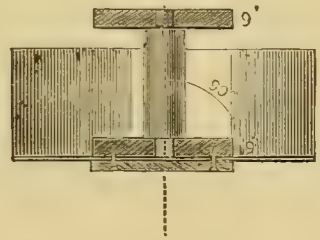


FIG. 13.

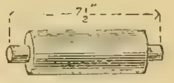


FIG. 11.

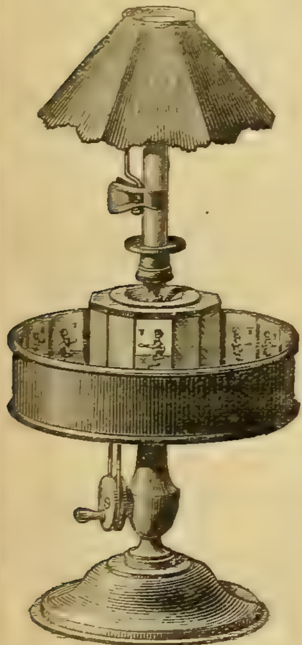


FIG. 15.

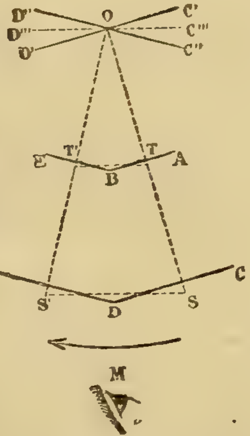


FIG. 16.

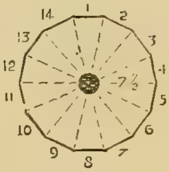


FIG. 9.

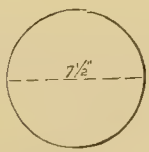


FIG. 10.

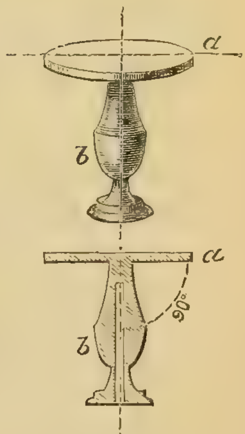


FIG. 14.

FIG. 4.—THE PHENAKISTISCOPE (COPIED FROM ILLUSTRATION IN M. STANISLAS MOUMER'S WORK ON NATURAL PHILOSOPHY). FIG. 5.—THE ZOETROPE OR WHEEL OF LIFE. FIG. 6.—IRON STAND OR BASE FOR PRAXINOSCOPE. FIG. 7.—WOODEN STAND OR BASE CONCEALING IRON PLATE IN FIG. 6. FIG. 8.—CASE SHOWING SHAPE AND SIZE. FIG. 9.—POLYGONAL DISC FOR INTERIOR OF CASE. FIG. 10.—CIRCULAR DISC. FIG. 11.—CYLINDER WITH ENDS REDUCED. FIG. 12.—CYLINDER WITH POLYGONAL DISCS FITTED ABOVE AND BELOW. FIG. 13.—DIAGRAM SHOWING CONNECTION AND FITTING TOGETHER OF CASE, POLYGONAL DISCS, AND CYLINDER. FIG. 14.—PEDESTAL FITTING OVER ROD A IN FIG. 6. ON WHICH FIG. 13 IS PLACED. FIG. 15.—PRAXINOSCOPE COMPLETE, SURMOUNTED BY CANDLESTICK, CANDLE, AND SHADE. FIG. 16.—DIAGRAM EXHIBITING PRINCIPLE OF PRAXINOSCOPE.

enough. I daresay many of my fellow-amateurs will not be able to make this case themselves, though there is in it nothing impossible nor even very difficult. If they will refer to Vol. II. (or Parts XII. and XIV.) of this Magazine, they will find a few articles by Mr. G. Edwinson which will help them in soldering zinc, etc. The case is 15 inches in diameter, and $4\frac{1}{2}$ inches high. Instead of being round, it ought, theoretically, to be made in the shape of a fourteen-sided polygon; but it would render its construction still more

FIG. 17.—EXAMPLES OF PICTURES FOR THE PRAXINOSCOPE.

difficult, and it would not make any difference. The interior and bottom must be painted white, and the outside of a brownish colour, or, in fact, any dark colour. Cut now three more pieces of wood. Two in the shape of fourteen-sided polygons, each side being $1\frac{5}{8}$ inches long. Let the wood be 1 inch thick, and $7\frac{1}{2}$ across from one of the sides to the opposite one. Deal will do for the polygons. These polygons must be cut with all sides *exactly* alike, because if it were not so, some bother in the making would be met with. Fig. 9 represents one of the two aforementioned pieces. The third piece (Fig. 10) must be made of oak, and about the same thickness as B (Fig. 7) and must be round, the same diameter as the polygons. Get now a cylindrical piece of wood $7\frac{1}{2}$ inches long, on which two shoulders are to be cut out, as in Fig. 11. The shoulders must have the same height as the thickness of the polygon. This piece may be square if more convenient. A round hole must be cut out in both polygons for the shoulders to fit in (see section of this in Fig. 12). This part, too, must be made very accurately, and, need I say it, A must form a right angle with B and B′.

By means of three or four screws, Figs. 8, 10, and 12, must be fastened together, so as to present Fig. 13. Great attention must be given when you assemble A, B, and B′, to place the sides of polygons exactly corresponding; if not, the whole thing is spoiled.

We will now occupy ourselves with the next part to be made: this is the handle, if I may call it so, of the Praxinoscope. It is a thick, turned piece of wood, seven or eight inches long (if elegance be no matter, it may be square), whose elevation and section are seen in Fig. 14. The part A, is a little round board glued on it, and through part B is bored a narrow hole as deep as rod A (Fig. 6) is long, or rather just a

trifle shorter. The inside of this long hole may be furnished with a piece of brass tube fitting exactly, but *not* tightly, of course, in rod A. By means of screws, or by gluing it on, the piece A (Fig. 14) must be fixed on 10 (Fig. 13), and our Praxinoscope will be complete when we have placed the glasses or mirrors. Get fourteen pieces of looking-glass of *exactly* $7\frac{1}{2}$ inches long and $\frac{5}{8}$ inch broad (the same width as the sides of polygons, and the same length as Fig. 11). I should advise my fellow-amateurs who can cut glass with a diamond, to cut these pieces themselves, as I do not think a glazier will do it with enough care to get them all alike. Place them one on each side of the polygons, fastening them at top and bottom with two bands of good india-rubber, which will keep them tightly on the side they belong to without injuring the quicksilver at the back.

The Praxinoscope is now finished and ready for work. On the top of mine I have added a little low candlestick which I made myself with some little pieces of tin, on which I put, when I use it in the evening, a good quality wax candle provided with a lamp-shade bearer (see Fig. 15). The Praxinoscope is ready, but not the pictures. Some examples of these are given in Fig. 17. Messrs. H. G. Clark and Co., *Garrick Street*, *Covent Garden*, *W.C.*, used to supply a large variety of pictures for the Zoetrope, but I am not aware if the firm is still in existence, and if not, into whose hands the stock, which was large and varied, may have passed.

I may lastly add that this Praxinoscope does not require to revolve at such speed as the old-fashioned Zoetrope. A quick impulse given by the hand will be quite sufficient if the pivot is properly made and if the handle is not too smooth, or it may be made to revolve by the contrivance indicated in Fig. 15.

MAGIC-LANTERN SLIDES:

HOW TO MAKE THEM AND PAINT THEM.

By Rev. O. BECKERLEGGE.

IN the articles which I have written so far for AMATEUR WORK, I have chiefly dealt with the mechanical appliances of science. I now propose making a departure, and give some instructions on the artistic side. A lantern, like a microscope, is useless in itself—only a means to an end—the end being the object to be viewed. To one who has more money than skill or patience, the readiest way to procure objects will be to purchase them, but this, except in certain circumstances, is neither so economical on the one hand nor pleasure giving on the other. As a rule, our own handiwork, other things being equal, will yield us more pleasure than that of others; that being the case I most persistently urge the amateur worker to acquire the art of painting his own slides. And then a hand-painted slide will yield better results than any other kind. A coloured photograph will at best be hard and unsympathetic—too mechanical; and a transfer picture will be more or less a daub.

But I shall be met with the objection perhaps—"I cannot paint, nay, more, I cannot even draw." Well, strange as it may sound, the lack of the latter art matters but little to a beginner—the art of painting may be learned at the same time the art of drawing is being acquired. This mystery will be cleared up as we proceed. But first of all, we shall want an easel. Now, as I believe in doing for myself as much as possible, I constructed my own. Fig. 1 gives a perspective view of it.

Make two frames—mortising the corners as A and B, Fig. 1. I used a part of a stout packing-case, so the cost of wood was almost *nil;* A is 18 inches by 12 inches, B is 18 inches by 13 inches—made of stuff 2 inches by $\frac{5}{8}$ inch; C is a trestle framed together, as shown and hinged to A, A and B are hinged together. The bottom bar of C is halved out at each end, and corresponding parts in the sides of A, so as to admit the easel being folded flat. A notch is cut at each side of B for the bottom bar to catch in, so that the easel may be retained in position. D is a lath 2 inches wide and $\frac{1}{4}$ inch thick—a rebate is taken out on the top edge. This is fastened to the frame by screws. E is another lath of the same dimensions as the former with a rebate taken out at the bottom edge. The under-side of the inner edge of A A' is chamfered, as is shown in A, Fig. 2, F F are blocks with a chamfer to fit A A' screwed to the lath E. This lath will now slide up and down, and will securely grip the glass side in the rebate, whether the slide be square or round. The easel is not difficult to make, and is an essential.

Materials (*Glass*).—Procure a number of glasses for slides, $3\frac{1}{4}$ inches square; these should be of good flat sheet, without flaws or scratches. Care must be exercised in the choice, as every speck will be magnified in the same proportion as the picture.

Colours.—Some care must be observed in selecting colours, as they must be only those which are transparent, and perfectly ground. The most satisfactory procedure will be to procure your colours from a manufacturer who makes a speciality of these things. Messrs. Reeves and Son, 113, *Cheapside*, *London*, *E.C.*, have supplied me with colours, varnishes, etc., of the finest quality. I have found them uniformly courteous, and always willing to oblige a customer and render advice, if needs be, in selecting materials. I should advise the amateur to send and

procure their catalogue, it will be of great service, as then one can see the cost of the materials they require as well as gain a great deal of other information. The colours are in tubes—a list of which, with prices, I give, it being understood that all the colours mentioned need not be procured at once, but can be had as required.

Blues.—Chinese, Prussian, Indigo. *Yellows:* gamboge, yellow lake, Italian pink, yellow madder. *Reds:* crimson lake, madder lake, pure orange, burnt sienna. *Browns:* vandyke, madder brown. *Green:* verdigris. All the above may be had in 4d. tubes, except madder lake and French ultramarine, which are 1s.

Varnishes, etc.—Copal, mastic, gold size, and pure turps.

Brushes.—From six to twelve sables, ranging from 0 to 6, varying in price from 6d. to 1s. One or two should be stripping or "rigger" brushes for fine lines, and a round hog hair.

Palette.—Procure a slab of plate glass 6 or 8 inches square, on one side gum a sheet of white paper, by this means we shall be able to judge our colours better than on a wood palette. Besides these we shall require a *palette knife* which must be thin and flexible with a true edge—this will be needed for spreading and mixing colours on the slab, and an *eraser*, a sharp pointed penknife for removing specks, scraping rough lines even; also, to remove colour sometimes to make high lights, etc.

Mixing Colours.—This is a subject on which we can speak only in a general way; as experiments and practice will soon enable the amateur to produce the tints desired.

Various shades of *green* may be made by the mixture of either Italian pink, gamboge, burnt or raw sienna, with blue; in no instance should more than two colours be used, as then the tint is less pure; *purple* is formed by blue and lake; *warm* grey for shadows and distant hills, blue, lake, and a little Italian pink.

Scarlet.—Madder lake and Italian pink; the former in excess of the latter. Messrs. Reeves are, I believe, preparing a pure scarlet.

Mediums.—No. 1: Mastic varnish three parts, turps one part. Mix with a gentle heat in a wide-mouthed bottle, a pomade bottle is the very thing, but be sure there is no grease in it; keep it securely corked when not using it. This is to be used with lampblack for outlining. No. 2: Mastic varnish, $\frac{3}{4}$ ounce, turps one teaspoonful, and twenty drops of pale drying oil or gold size; this is for general use with colours. Let these be labelled, that no mistake is made in using them; we shall also require a small vessel containing turps, in which to clean our brushes. This I must emphasize—every trace of colour must be removed from the brush *as soon* as that particular colour is done with, the brush must be frequently washed, also to remove all stickiness. If the colours are not perfectly pure, a good picture will be impossible. It is in these little and seemingly little matters where amateurs generally break down, and very often in written instructions these small details are overlooked, hence written instructions are often failures.

Whilst we have been making these arrangements, I take for granted that we have been keeping our eyes open for suitable subjects. We must "make haste slowly"—good practice will be obtained by copying grotesque heads and figures found in some of the comic papers. Fig. 3 will be a suitable subject to commence with. A good plan to adopt is to cut a hole 3 inches square out of a piece of cardboard, and when we see a small picture that we think eligible for our purpose, place the card over it; by this means we shall be able by shifting it from one place to another to fix on the most suitable part. We must be careful to secure a definite object in the foreground; this will give distance to those objects which are naturally more remote.

I will suppose we have secured our subject, let us now proceed to work. I have said that it is not absolutely necessary for us to be clever at drawing to make fair slides. I will now more fully explain myself. Take a sheet of tracing-paper and lay it on the engraving or woodcut; if it is a very distinct and heavily cut picture, it may be necessary to lay two sheets of tracing-paper on it. Now lay the glass over the tracing-paper and fasten them all together in a temporary, though secure, manner. The tracing-paper softens down the lines and renders tracing them on the glass more easy. We must now take a little of medium No. 1, and place it on our colour slab, and also place a little lampblack out of the tube. Well mix them, adding a little turps to thin down, if necessary. Take the long hair sable (rigger) and see that there are no straggling hairs: if there are any, cut them off; also see that the hairs come to a fine point, and dip it in the paint, drawing it to a point. Now, with a firm, steady hand, follow the outline of all the objects, the process being like that employed by the child with its so-called transparent slate. The more distant parts must have a light line, whilst those that are nearer and more distinct must have a bolder and heavier stroke. There must be no attempt at shading, simply outlining the objects. Now, considering that these lines will be magnified, say from thirty to sixty times linear, it is of the utmost importance that they shall be regular and true, else a line seemingly good, when magnified, will appear a mere ragged scrawl.

To assist us in the matter, we must supply ourselves with a magnifying-glass, such as is held in the hand for viewing pictures, etc.; let it be about five

inch focus. If when magnified, the lines are in places ragged, then we must, either with the eraser or pointed penknife, scrape the ragged edge off or remove the line altogether, and redraw it. Of course, it will be understood that before any attempt can be made to erase any line, our work must be thoroughly hard. I do not advise baking the slide at this point, let it stand, say forty-eight hours, after which place it in a warm oven—not hot—for an hour or two; it will not then be likely to work up in future painting. The slide must stand on its edge, falling at any angle with the drawing on the under side; in this position dust will not settle on the outline.

We will now fix our slide on the easel, the two rebates will hold it securely. Underneath the easel we must lay a sheet of white paper, and so place it that a good light shall fall on it. The paper will form an admirable reflector, and now by the aid of the hand-glass we shall be able to see any defects which may be in the outline, when they must be rectified as indicated.

I will suppose we have made several copies—say half a dozen of Fig. 3; do not be afraid of a little trouble to begin with, it means training, and the good will be seen ultimately. Take the best and proceed to paint it. Always remember to begin to work at the top on the left hand, you will then be in no danger of smudging the picture with your hand; this is a wrinkle not to be despised. Place a little of medium No. 2 on the palette, and squeeze a little crimson lake and burnt sienna on the palette. Mix small quantities of each together with the medium, until you produce a desirable flesh tint. It will be necessary to have a piece of glass handy, so that the tint of all colours may be tested before they are laid on the slide. It must ever be remembered that if one colour is laid on too light it can be easily remedied; but if too heavy or dark, it is fatal; hence, we must be careful of our colours when working. Take a medium size brush and fill it with the colour, begin at the forehead, bring the brush well out to the outline, so that no hollow spaces are left between the colour and the lines. Sweep the brush down the cheeks and over the nose, with a quick, steady stroke, working the colour across towards the right, and well up to, and slightly under the hair, the whites of the eyes and collar being left perfectly clear. When the whole is covered and before the paint has had time to set, clean the brush and draw it between the finger and thumb to flatten it. Now go over the whole with light strokes, making sure that every part is covered by stroking it at right angles. If this is done quickly before the paint has had time to harden, the marks of the brush will be quite obliterated in a few seconds, the little ridges of paint falling into the hollows and assuming a common level. Whilst doing this, we must be careful to remove all superfluous paint. Where we began and where we finish must alike be free from pools and ridges.

When the face is done to our satisfaction proceed with the hands in the same manner. We may now turn our attention to the hat: Prepare some yellow with the medium as before, and work it on from the front to the back; also use the same for cuffs of coat. Use sienna for the hair, paying attention to the outline of the hair on the face, otherwise it must be just a flat even colour. The coat should be painted a blue somewhat light in tone. The bow under the chin may be painted crimson.

So far we have completed our first operation. The picture must now be carefully placed where no dust can fall upon it, standing in the position already indicated. We need not be in a hurry—let it stand a day or two until it gets perfectly hard. If the weather is cold and damp our work will dry and harden but slowly; in that case, it will be better when the work has stood, say thirty hours, to place it near the fire for an hour or two, to get perfectly hard. When in working condition, it must be examined very carefully, to see if any specks or bits of fluff have settled on it. These must be removed by a soft brush or bird's wing. If any have stuck in the colour, they must be carefully taken out with the point of a knife. Be careful in the selection of your rags used in cleaning your brushes, etc. Never use cotton rags, as they are always fluffy, but use linen. We must keep constantly before our mind the fact that a flaw or an imperfection that can hardly be seen in the painting, may, when magnified on the screen, destroy an otherwise good picture. So we must keep our eyes open and use our glass freely.

We are now ready to commence our second painting. We must proceed in the same order as before, but with colours of a lower tone than the first. Mix crimson lake and burnt umber with medium No. 2, in such proportions as will give a warm flesh tint. At the expense of repetition, I must warn you against making your shadows too heavy by a single painting, they can always be deepened by subsequent coats, but never made lighter. Take this colour and commence under the cap and hair, laying the shadow where it would appear in nature. Use but little colour at a time. By gentle strokes, draw it down from the hat nearly, but not quite to the eyebrow. The eyebrow being prominent, naturally receives more light. The colour must be brought down under the hair, working thinner towards the cheek, so as to produce roundness. Mark out the shadows of the ears. Next put the shadow under the eyebrow, deepest at the top, fading away as it approaches the

eyelid. Over, and in front of the cheek bone, the top lip, the front and under the chin, must all be treated in the same manner, working the colour thinner towards the centre so that the face may show good modelling. The shadow behind the jaw and neck must not, however, be thinned out, as the jaw stands out sharp. Indicate the nostril by burnt sienna, then mix a little crimson lake with it for the lips, and with a touch of crimson lake give colour to the cheek. Shade and model the hat with the yellow first used, strengthened with burnt sienna. Put in the crisp curls of the hair with vandyke brown. The coat must now receive our attention. Under the lapel, behind the arm and around the hump, the colour must be deepened. Prussian blue is the colour for draperies. We must be careful when putting on our shadow to preserve transparency, for the deepest shadow we will use just a little lampblack; but this had better be left till the last painting. The buttons may now be put on with indigo.

When we have completed the second painting, our work must be put aside to harden as before, the treatment being the same. When hard we shall be able to see if any parts lack transparency; if so, then we must give it a very thin coat of mastic varnish, laying it on with your hog-hair brush. Thinner the coat of varnish is the better it will be, as you only want to render the paint transparent. When hard, which will be the case in a few minutes, we must give the third coat. This in the case before us will be little more than deepening the shadows, where the smallest amount of light falls, such as the back of the hat, eyebrow, front of upper lip, and back of neck, then the coat must receive attention. The shadows behind the arm and around the hump must be deepened by adding a small quantity of lampblack to the blue, but not sufficient to be opaque; indigo may be used for the buttons.

Our next work must be to fill in the slide with a ground of black. For this purpose we must prepare a "stopping out" medium as follows: Asphaltum, $\frac{1}{2}$ oz., dissolved in turps; if the asphaltum be broken small, and the bottle put in a warm place, it will dissolve in a day or two; this operation will be facilitated by an occasional shake up. It should, like the other mediums, be securely corked when not in use. Lay a little of this on a piece of glass, and add powdered lampblack in sufficient quantity to form a thickish paint; be careful that the pigment is *finely ground* before mixing, and also add a few drops of mastic varnish.

This paint must now be thoroughly ground on glass until every trace of grittiness is removed; if too stiff for working, a few drops of turps will bring it to the right consistency. We have now a black that will effectually stop all light. With a "rigger" brush lay on the black close up to the outline of the figure, seeing that whilst on the one hand it does not overlap the lines, on the other hand there are no hollows between it and the lines. When you have gone quite around the subject with your "hog," paint the margin quite to the edge. When this is dry, turn the slide on the easel, and paint the other side, being careful *not* to come quite up to the figure, but say one-eighth of an inch from it. The margin of the slide will be absolutely light proof

FIG. 3.—EXAMPLE OF GROTESQUE SLIPPING SLIDE.

As we intend using this slide with a slipping glass, for the purpose of elongating the nose, we had better make a frame for it at once. Get a foot and a half of mahogany a full half inch square; rebate one edge like the frame of a picture, cut away $\frac{1}{8}$ inch of the wood, leaving the tongue $\frac{1}{8}$ inch thick; a cross section is given, Fig. 4. Cut off four pieces and mitre the ends to make the frame; let it be just large enough to take the slide. One side, however, must have a piece cut out as will appear plainly further on. When the mitres are made, the mode I adopt to join them is the following: Glue the ends and place them in position on a flat surface. Now pass a piece of strong twine around them two or three times, and firmly tie the ends of cord. Have ready eight small wedges about half inch square, put them under the cord, two on each side, and draw them gradually towards the four corners: do not pull two wedges on one side up to the corners before pushing the others in their place, but keep the pressure on each

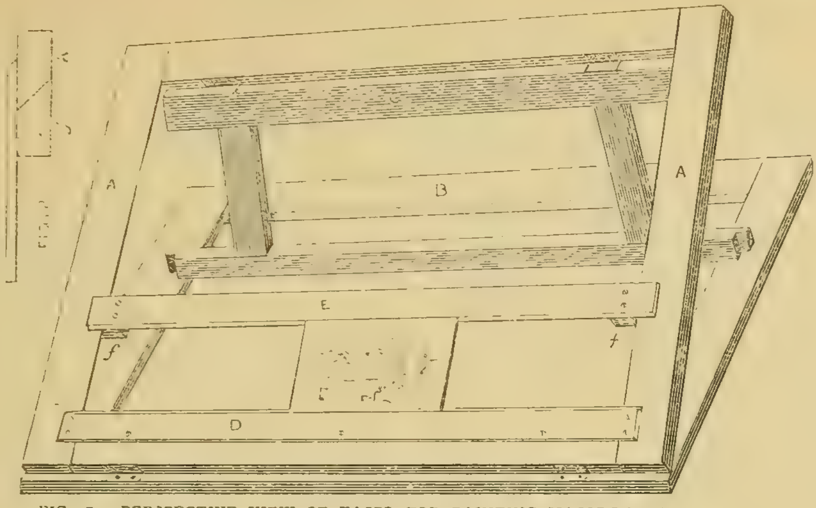


FIG. 1.—PERSPECTIVE VIEW OF EASEL FOR PAINTING MAGIC-LANTERN SLIDES.
FIG. 2.—FORM OF UNDERSIDE OF INNER EDGE OF A A′ IN FIG. 1.

side even. When the frame is wedged up as tightly as possible put a brad — first boring a hole —in each corner. I dare say this is a plan common in practice, though I do not remember seeing it recommended anywhere. I adopt this plan for frames of all sizes, and find it the best by far of any I have tried. Fig. 4 will make the whole arrangement clear.

We must now take a piece of glass $3\frac{1}{4}$ inches by $3\frac{3}{4}$ inches, with an angular piece taken off on one of its long sides (see dotted lines, Fig. 4). This is for a slipping slide. In Fig. 3 you will perceive that the proboscis is divided by a line, which converts it into a "Roman" nose. Our slipping slide is to convert the "Roman" into the absurd proboscis. I will here take the opportunity of saying what I find I have overlooked; that is, that in making the outline of the figure, no notice must be taken of this divisional line: it is placed there simply for our guidance in making the slip. Put the painted slide in its frame on the easel, and with a strong needle set in a pen-holder for handle, scratch three fine lines from the point of the hat, as shown in the figure, and make a minute ring at the end of each; also, make just a few small scratches from the nose and chin to represent hairs. I ought to have mentioned before that in the third painting the creases across the brow should be put in, and also a few dark hairs on the side of the nose and chin.

However, as the article will be read no doubt a time or two before actually commencing work, it is not too late to supply the omission. And I may perhaps be pardoned for making a further remark at this stage. I would recommend anyone who thinks of beginning to work seriously, first of all to read the article through carefully two or three times, so as to have a fair idea of the whole process before beginning to paint.

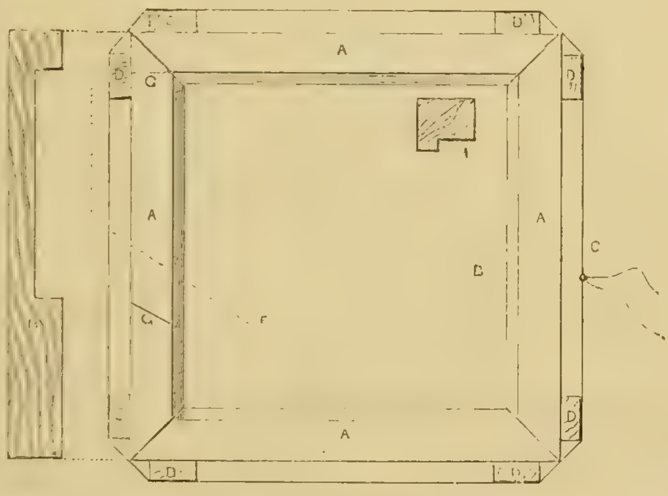


FIG. 4.—FRAME FOR SLIPPING SLIDE.

A, Frame rebated as at B; C, Cord tied tightly round Frame when Glued together; D, Small Blocks of Wood put under cord and drawn to corners to make good joints; F, Dotted line showing shape and size of Slipping Slide; G, G, Piece taken out of one side to allow Slipping Slide to be drawn out; H, View of Edge of Frame, showing piece taken out; I, Section of Frame showing Rebate.

Having placed the slide in, it will be a wise precaution to gum a slip of card or paper $\frac{1}{8}$ inch wide on the top and bottom to prevent the slipping slide from actually touching the paint. Now lay the slip in its place, and with a brush charged with black paint draw a line so as to make a Roman nose, and blot out the elongated portion. With four needle points, two at top and two at bottom, keep the slide in its position. Now in drawing out the slide when in the lantern the "Roman" will gradually appear to grow into a grotesque "trunk," much to the astonishment of the youngsters. We can now varnish or polish our frame; glue a bit of cloth as a thumb-piece to draw the

slide with, paint the date on the slide, and whether imperfect or otherwise, will call it finished. This last thing—dating the slide—I would urge upon you to do in every case ; it affords a ready means of judging your improvement, and also in time to come will bring back perhaps pleasant memories. At this point let me say a word both of warning and of encouragement. I feel confident that when your work is completed it will not come up nearly to your ideal of a good lantern slide. Can you expect it? But this will have been done: you will have laid the foundation on which you may go on working, until you shall reach a degree of excellence which shall give you pleasure, and, what is more, shall give pleasure to others.

I confess I like to come across a bit of work done years ago, that I may compare then and now, and see that both eye and hand have responded to some extent, in an honest attempt at their culture, the pleasure is pure and substantial.

(*To be continued.*)

PATTERN MAKING FOR AMATEURS.

By ARTHUR J. SCOTT.

I.—INTRODUCTION—TOOLS—RULES, ETC.

I SUPPOSE I have not a reader of these articles who will ask the question, "What is pattern making?" if I have, I will try and answer that question in as simple a way as ever I can. My own experience is this : "Pattern making is the art of making an exact model like the casting required, the said model being made so that it will leave a mould in sand like it, to pour the metal into." Pattern making is an art that will be practised by amateurs, more in a preliminary form, if I may term it so, rather than in an extended form, as is practised in most workshops. My reason for this is, the amateur will require so few castings compared with an engineering establishment, therefore, he will, as a matter of fact, in the same ratio, have fewer difficulties to contend with and battle against.

This last forty years, I might say, pattern making has undergone a rapid change, and not only that branch, but all branches of the engineer's art has made most rapid progress this last half century. The praise is not all due to the machinery that has been brought out and perfected during that time, but I believe the workman has improved as much, if not in the same ratio, not far behind. As an example, it would astonish and open the eyes of the pattern maker of forty or fifty years ago if he were to see the shrinkage allowance that is now made on patterns, such a thing then was never heard of, much less seen. The reason, in my humble opinion, is not difficult to find, for until of late years there was always a great gap between the foundry and the machine shops, so much as an inch has had to be left on the patterns, not knowing to a surety what size they were going to get the castings until cast, which I have no need to tell you, was often a great expense, great loss of time and labour, all owing to the inaccuracy which then prevailed. In comparison, notice the workshop practice of to-day, the object being, in a great many cases, to get as near the skin of the metal as possible, except in cases where it is desired soft for some special purpose. You will see about one-sixteenth of an inch allowed for fitting, etc., when sometimes one inch would not suffice in the old days, so you will see there must at the present time prevail a great deal of accuracy on the pattern makers' and moulders' arts, compared with fifty years ago. This improvement is demanded by the purchaser, so that the producer is compelled to improve his product in order to supply the exactions of the demand at the price required.

Take for instance the art of scraping, forty to fifty years ago, ay, and less, the work of the planer was supposed to have finished the work on completed tools. The movable head of a lathe was not supposed to be in working order until it had been in use six months, and so with the planer cross-head the same can be said of, and other things too various to mention. To-day we see them got up frosted and scraped, somewhat beautiful in finish, working as well the first time used as after months' use. This scraping of surfaces has come more nearer to perfection of late years than has been dreamt of before. What has got Whitworth and Holtzapffel the name they have for tools, etc.? Why, nothing, only the get up and the accurate workmanship combined, in their use ; so you will see the wonderful progress that has been gone through of late years. In the course of these articles, I cannot say this much, that any amateur who reads them can become a pattern maker directly after, for that it is impossible; but I will say that any amateur who follows me in these articles, will, with a very little perseverance, be enabled to make all the patterns that ever he will be likely to require in his mechanical needs for them.

Now for a little bit of advice : In going to a foundry you may have chance to look through a pattern shop, if so, notice the patterns therein making, for "an ounce of practice is worth a pound of theory ;" the knowledge you may get in so doing might serve you in good stead. "Never throw knowledge away." In a few places, pattern making is dying out for large castings, but the difficulty of the pattern maker's art is increasing at the same rate, for he has to contrive to supply skeleton-like objects of the thing required,

sufficient and enough to tax his inventive powers to the utmost; of course, in the case of a speciality, even of a large casting, it is better to have a pattern, and, in some cases, iron ones are cast where there is a large quantity required.

There are two methods generally practised in moulding: Firstly, green sand moulding; secondly, loam moulding. The first is what our amateur's patterns will be moulded by, and is what a great deal of the work in Lancashire and elsewhere is moulded in. Loam moulding is generally understood to be moulds struck up circular or otherwise by strickles or boards cut out to the shape required, and worked from a spindle or guide. These moulds are very expensive making, and will hardly come within the amateur's province: however, if any of our readers desire instruction on this point, I shall only be too glad to give them the information; the cleanest castings are supposed to come from loam moulds and dry sand moulds. The last named is a method of moulding that has come into use of late years, more so than before. The difference between the last named and the green sand mould is, one is dried in the stove and a different quality of sand used, and the other is not.

In the course of the publication of these articles, if any reader or amateur is wishing to make a pattern of anything which he thinks would be of service to the other readers of this Journal, I will, with the Editor's permission, in the course of my articles, give him full instructions in the making of the same, provided he sends a completed drawing of what he requires to the Editor, who will forward same to me, which being done, his wants shall be attended to forthwith.

In commencing to make a pattern, the amateur would do best before starting to have a complete drawing of what he requires; if it be at all an intricate one, let it be a full-sized drawing. If too large for paper, draw it on a board, it will be there to work to all the time the pattern is in progress, and it will enable him better to see whether he is going on right or not, as so many little details are not thought off in small scale drawings, that it is only in getting them life size that they are seen to be needed. The next thing I would advise the amateur about is the proportioning of the metal. Do not let a solid lump of perhaps 4 inches in thickness be against a $\frac{1}{2}$ inch plate, the 4 inches in cooling will be quite hot, while the plate has cooled long ago, then the thick lump contracting might possibly break your thin plate for you. What I mean to drive at is this, instead of putting thick and thin metal together, almost equalise them both—that one which requires to be so much stronger, well support it with brackets, etc.

After the drawing, comes the pattern to be considered, which, if he makes to his ordinary two-feet rule, will come back a different size altogether, and if large, and other articles has been made for it, would probably render it useless, this would be owing to the shrinkage of the metal, as I have spoken of before. I append with this article four illustrations, each giving 6 inches of measurement, but in every case each one will be found different in length. In Fig. 1 (A) we have the ordinary standard measurement. Fig. 2 (B) represents the extra length for contraction in cast iron in a length of 6 inches. In Fig. 4 (D) we have what is called double contraction, used whenever an iron pattern is required. In Fig. 3 (C) we have contraction for brass; from the lengths given you will be able to construct rules for yourself. The best wood for the purpose is lance or sycamore, about 2 feet long, 1 inch broad, and $\frac{3}{16}$ inch in thickness. You will see that the extra length required for contraction does not show very much in the diagrams of lengths of 6 inches; but if you set out rules, as I propose, of 2 feet in length, you will then perceive the great difference in the length that I speak about.

In regard to the pattern, some people seem to think the rougher the pattern the smoother the casting; in my experience it is not so, though I will say a great deal depends on the moulder who does the job. I know of one firm, a well-known firm, "The Coalbrookdale Co.," Shropshire, where I have heard it said that if a finger mark shows on a pattern in construction, the same will be impressed on the casting from it. I tell you this to show you the difference of opinion which exists on the subject. Some people think one way, some another; this I do know, if any amateur, be he amateur or not, it makes no difference, desires a good clean casting, he must on the same lines make a good substantial pattern—one that has plenty of strip (taper) in it to clear itself well from the sand, in drawing, and not drag and bring lumps of sand with it; it must, to be able to do this, also be nice and smooth all over it. If anyone sends a rough pattern, half filled up with putty, etc., he must not be surprised at receiving a very scabby casting in return, besides occupying the moulder much longer, so that an extra half hour ought not to be grudged.

Another thing that must be attended to in making a pattern is this—let it be well fastened together; if it is not, it will not come back to you whole, but in segments, so don't be frightened of putting an extra screw or sprig through the joints, for if you don't, the moulders have a knack of finding out all weak places to knock their rapping and lifting irons in, etc., so it is much better to see this well attended to first, before the moulder gets the pattern.

After a pattern is finished, let it be glass-papered all over and varnished; the best varnish I am

acquainted with for the purpose being composed of naphtha and shellac. Get a wide-mouthed bottle, such as a pickle jar, half filled with the best orange shellac, and just pour sufficient rectified spirits of naphtha to just cover the shellac already in. The pattern will require several coats of this varnish, also glass papering after every coat of varnish is dry. The main body of pattern must be varnished this colour, but all planed or turned surfaces must be varnished red, which will enable the moulder to distinguish where good metal is required. The red varnish is made by the addition of a little red lead; and all core-prints and core-boxes I should advise varnishing black, which can be done by adding a little lamp-black to the varnish already prepared; the core-prints ought to be black varnished before fastening on the pattern. If you follow this method it will prevent confusion and save you expense.

The timber you will mostly use for pattern making will be the best soft pine without shakes or knots, and for small delicate work I should advise baywood, as it will stand a little more knocking about by the moulder than pine, besides being all the better and easier for you carving what is required.

I will now enumerate the tools and appliances that you will require. I don't think, but mostly all amateurs will have at least the majority. First of all is a good bench; we have had several good ones described in AMATEUR WORK lately, so there is no necessity for the describing of one here; but in my next possibly I will notice some of the disadvantages of the ordinary bench, and will infer that every amateur who does any joinering at all, has one or is intending to get one.

The next important article is a good lathe. Now here, I think, I shall be wrong in stating that *every* amateur has a good lathe, but Olla Podrida has described a 6-inch wooden lathe which is a very good one, so I should advise those persons not having an iron one to make one as he describes; if not desirous of a lathe, there are plenty of turners in a town who would do a small bit of turning for a nominal fee, so there is plenty of chances to get it done.

After a bench and a lathe comes his bench tools. I will mention a complete kit, and then the amateur can cut it down to suit his means, but a great many of the tools he will have. I have no doubt any of the tools which need special describing will be done so.

I will now append a general list of tools required and used by each workman in pattern shops;—

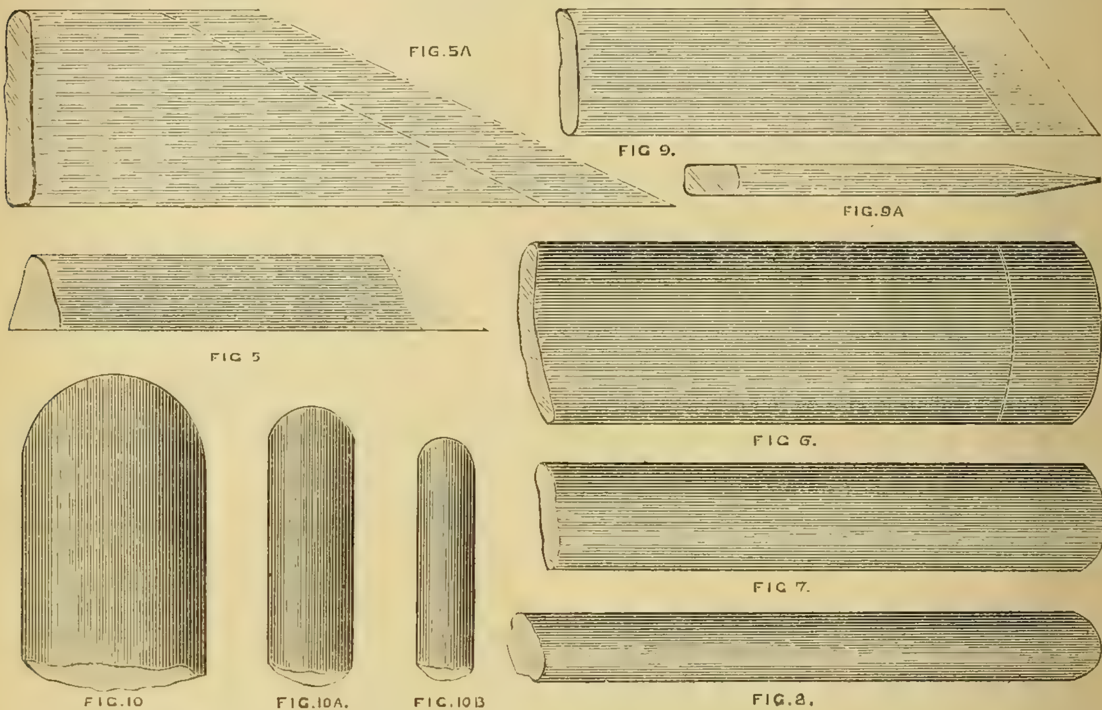


FIG. 5.—DIAMOND POINT. FIG. 5 A.—LEFT HAND EDGE TOOL. FIG. 6.—LARGE ROUND NOSE. FIG. 7.—MEDIUM ROUND NOSE. FIG. 8.—SMALL ROUND NOSE. FIG. 9.—CUTTING DOWN TOOL. FIG. 9 A.—SIDE VIEW OF DITTO. FIGS. 10, 10 A, AND 10 B.—SWEEPS OF TURNING GOUGES.

Saws.	Planes.	Chisels. (Long Paring.)
Rip	Trying	$\frac{1}{8}$ in. bevel edged
Cross Cut	Jack	$\frac{3}{16}$ in. ditto
Fine Cross Cut	Smoothing	$\frac{3}{4}$ in. ditto
14 Tenon	A Few Stop	$1\frac{1}{4}$ in. ditto
Dovetail	$\frac{3}{4}$, 1, $1\frac{1}{2}$, and 2 in. Rebate	$\frac{1}{4}$ in. ordinary long
Pad	$\frac{5}{8}$ Trenching	$\frac{1}{2}$ in. ditto
Bow	$\frac{1}{2}$ Set Rounds	1 in. ditto
	Iron Surface	$1\frac{1}{2}$ in. ditto
	Skip Jack [Jack (loose soles) Round Sole	$\frac{1}{16}$, $\frac{1}{8}$, $\frac{1}{4}$ in. mortise

FIG. 1.—RULE EXHIBITING ORDINARY STANDARD MEASUREMENT.

FIG. 2.—RULE FOR ORDINARY CONTRACTION FOR CAST IRON.

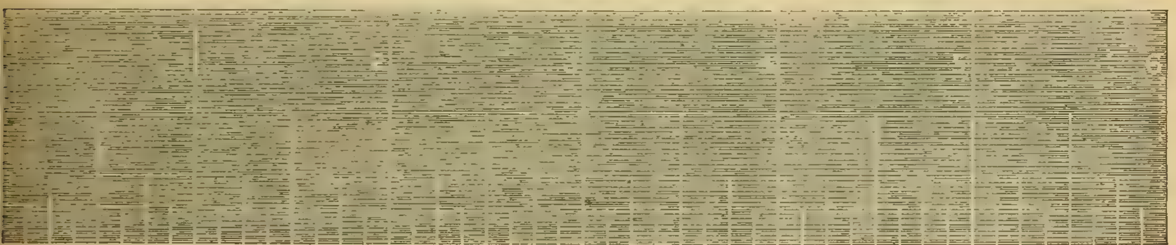


FIG. 3.—RULE FOR ORDINARY CONTRACTION FOR BRASS.

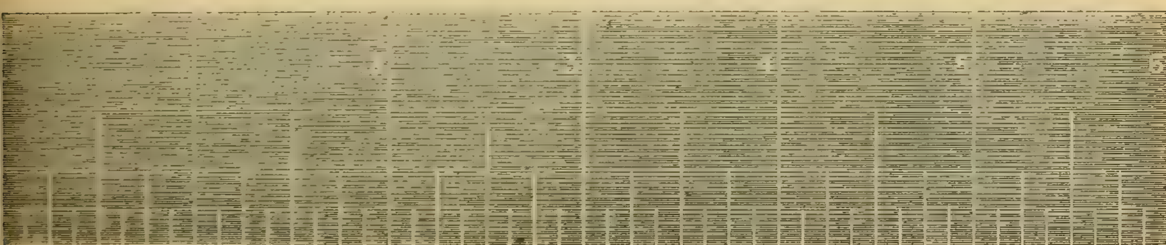


FIG. 4.—RULE FOR DOUBLE CONTRACTION FOR CAST IRON.

Gauges.	Gouges (long).	Gouges (short).
2 Ordinary Bench	Long paring, ground inside, size of circle on outside of gouge.	Ground outside, size of circle on inside.
1 Long Panel		
1 Cutting		$\frac{3}{8}$, $1\frac{1}{2}$, 3, 6 in.
Mortise	$\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, 1, $1\frac{1}{4}$, $1\frac{1}{2}$, $1\frac{3}{4}$, 2,	Squares
Skeleton	$2\frac{1}{2}$, 3, 4, 5, 6, 8, 10, 15 in.	4, 9, 15 in.
Long Tooth		Bevel and 1 large wooden Square

Callipers (insides and outsides), winding strips, trammels, compasses, dividers, mallet, about a dozen or eighteen carving tools (various), radiators, set squares, lubricator, large bevel, a good oilstone and some slips, a few spokeshaves, and about half a dozen flat turning tools, with about a couple of turning gouges, and an old woman's tooth.

You will find, on reference to the articles on "Handy Wood-Working Tools," a description of many of the tools mentioned above, such as the trammels, radiators, etc. You have now rather a formidable list before you, but I must tell you, even if you have the means, don't get all mentioned in the list at first; a better plan is, get them as you find you are needing them for the work in hand, for by so doing you will get a better idea as to their working capabilities, etc.

Those tools which you could not readily procure, and those which it will pay you best to make for yourself, I will describe as I have said before. In referring to the first four figures of the contraction rules, it would be better if you intend making a two-foot rule from them, of getting an ordinary standard two-foot and adding the additions that I will tell you of to it for the different metals; if you only make your rule about one foot long, you can easily transfer it from the figures given, only in making one over that length you could easily err in multiplying the length from the figures given, so in an ordinary iron contraction rule, if you add three-sixteenths of an inch to the ordinary standard measurement of two feet, you will find yourself not far wrong; for brass you must add five-sixteenths of an inch; and, of course, double contraction will be double of the first, namely, three-eighths of an inch longer in two feet than the ordinary standard measurement. The reason I have added sixteenths to the ordinary standard measurements is, I have thought it would be easier for the amateur than giving in tenths the extras for contraction; however, for the information of the few. I give the following: one-tenth of an inch in one foot for cast iron; two-tenths of an inch, of course, for double contraction, which is also sometimes used for brass contraction. In Fig. 5 we have a view of a very handy tool in turning, called a diamond point, from the way it is ground. As you will perceive, it is used for inside and recessed work; this and the following turning tools up to Fig. 10 B, ought to be a good length, twelve or fourteen inches being none too long in the length of tool and handle combined. If the tool is only a short length, make it up with a long handle. Fig. 6 is a very handy tool for finishing hollow turned work, and is called a left-hand edge tool. You can, if you wish for a complete stock, get one ground on the opposite side for a right-hand tool, but it is not required so often as the left hand. The dotted line shows the amount of bevel ground on the tool at the cutting edge; it should be about $\frac{7}{8}$ or 1 inch broad, by about $\frac{3}{16}$ of an inch in thickness. I omitted to state that the diamond point was made out of a piece of $\frac{3}{8}$ or $\frac{1}{2}$ inch square steel and hardened afterwards; the same also with Fig. 8, the small size of the round noses given. Figs. 6 and 7 show two different sizes of round noses, the cutting edge of Fig. 6 being at about three inch circle, and the other at about one and a quarter inch circle. At Fig. 9 is a very handy tool, known as a cutting down tool, and ground both sides, as seen from the two views, Figs. 9 and 9A. Figs. 10 and 10B show three widths of turning gouges, which it is advisable to get; they will be found, I believe, to answer all requirements.

(*To be continued.*)

SMITHING AND FORGING.

By GEORGE EDWINSON.

VII.—MAKING FARRIER'S TOOLS—HORSE-SHOES, ETC.

THE special tools used in the practice of farriery are made by the smith himself. Common tools, such as the hammer, rasp, and knife (Figs. 89, 92, and 93, in previous article) may be purchased at a low price from dealers in tools, therefore, it does not pay the smith to make them. Instructions for making pincers have been given in a previous article, under those given for making tongs.

Farriers' pincers (Fig. 91) should either be made of steel throughout, or the jaws should be made of nicely-tempered steel, well formed and fitted. The bits should be from $\frac{3}{4}$ to 1 inch in width, and these should be made to meet each other with a firm, square grip. The length over all should be about 8 or 9 inches. As this tool is used for drawing nails, pulling off shoes, holding under the heads of nails whilst they are being clenched, and twisting points off nails, they must be made light, yet strong, in every part.

The tool (Fig. 90) is sometimes forged, as shown in sketch, out of a piece of old file, when the tang is left large and long to form a handle; or a sharp tang is made and fitted into a horn handle. The blade is thinned and ground sharp, and it is then termed a "toe knife." This tool is used on the rough hoofs of cart and dray-horses to cut away massive, hard pieces of horn, not easily removed with the lighter knife, when it is struck on the back with a light hammer, and thus does duty as a chisel. Blunted and worn "toe knives" are used in cutting clenches, or they are forged into composite tools, the tang being made into the form of (Fig. 94), and the composite tool thus formed is named a "buffer" (Fig. 101), a handy combination, useful for cutting clenches and starting nails. These are all the tools generally used on a horse's hoof and in putting on the shoes. They should all be made of steel, nicely tempered, and are kept, when not in use, in a farrier's tool-box—a shallow box, fitted with a tray for nails, and furnished with an iron handle bent over the top, similar to that of a basket. This box may be made of $\frac{1}{2}$ inch yellow deal, and of the following dimensions: Length 15 inches, width 9 inches, depth $4\frac{1}{2}$ inches; nail tray, $2\frac{1}{2}$ inches in depth by 3 inches in width; handle, 15 inches of $\frac{3}{8}$ inch iron rod, flattened at each end into ears 2 inches in length, each pierced with two $\frac{1}{4}$ inch holes, and bolted firmly to the sides of the box with the handle bent across the middle.

Making Horse-shoes.—The tools used in making horse-shoes are, besides those usually provided in a smithy, a "fullering swage" (Fig. 102), a "pritchel

punch" (Fig. 103), a "pritchel" (Fig. 104), a "curved sett" (Fig. 105), and a pair of top and bottom "setts" (Figs. 106 and 107).

If the smith intends working single-handed, he should furnish himself with an extra large size ball-paned hand hammer, as heavy as he can wield with one hand. It will also be an advantage if he can furnish for himself an "Oliver," that is, a sledge-hammer slung in a frame in front of the anvil, and worked by a treadle actuated by the foot of the smith. This accessory points to the necessity for the employment of an assistant in the work of forging horse-shoes. An assistant striker, wielding a seven pound sledge-hammer, will make the work much easier than when carried on single-handed.

Fullering Swage, or "Fuller."—This is a tool used by smiths to make a groove in the under side of a horse-shoe for the reception of the heads of the nails. To make this tool, heat and upset the end of an inch bar of iron; then heat again and split with a sett, forming a fork from 1 inch to $1\frac{1}{4}$ inch in length by $\frac{3}{4}$ inch in width, as shown in Fig. 108. Heat the end of a bar of steel of similar size, and forge a wedge to fit the above named fork, as shown in Fig. 109. Heat both to a welding heat and weld well together; then cut off 2 inches of steel and 3 inches of iron to form the tool. First cut off the steel and forge this, with the iron part to form the tool, as shown in Fig. 102. Make the neck of the tool whilst on the bar of iron, and then cut off the required length, leaving a piece of the iron bar to form a head.

Pritchel Punch, or Punch for Nail Holes.—This is made of iron and steel in a manner similar to that for making a "fuller," using about 2 inches of iron and 1 inch of steel, and shaping the finished tool to the form shown in Fig. 103.

Pritchel, or Hand Punch for Nail Holes.—This is forged out of $\frac{1}{2}$ inch square tool steel to the form shown in Fig. 104, and to the length of 6 inches. As it will be used in punching nail holes in hot iron, it need not be hardened.

Curved Sett.—This tool should be made similar to a "fuller" in every respect except the shape of its blade or cutting part. This part should be made the shape of a gouge, as shown in Fig. 105. It is used in cutting off the surplus iron from the ends of horse-shoes whilst they are hot.

Hot Setts.—These are tools used by the smith to cut off pieces of hot iron. The bottom sett (Fig. 107) is, as will be seen, a wedge-shaped piece of steel and iron with a square tang. This tang is made to fit the square hole in one end of the anvil, and the wedge part then appears resting on the anvil with its edge uppermost. The top sett is made similar to a curved sett, but the blade is left chisel or wedge-shaped, as shown in Fig. 106. Both tools are made of composite iron and steel, similar in proportion to that used in making a "fuller."

All top setts and swages are furnished with handles made of rod iron or of twisted sticks. Rod iron handles are made out of $\frac{3}{8}$ inch iron rod twisted once around the neck of the tool, and finished off by welding the two ends together as shown, Fig. 110. Wooden handles are made of twisted hazel, willow, oak, or withy rods of about 3 feet in length. The green or half green rods are twisted for about 8 or 9 inches in the middle part, and this is twisted once around the neck of the tool as shown, Figs. 106 and 111. The two ends are then bound together with wire, or secured by a link.

As the weight of horse-shoes vary with the size and weights of the horses wearing them, and other requirements, it is clear that all shoes should be planned, before the iron is cut off. How should the novice proceed to plan a shoe for a horse about to be shod? What should be the shape, size, and weight of the finished shoe? By what rule shall he determine this as he takes the horse's hoof in hand? He may watch a farrier at work, and may note that the workman does not always fit a shoe to the hoof by making the shoe and trying it on; nor does he always measure the hoof before selecting or making a shoe. Measurement by the eye alone and judgment ripened by experience, is relied upon by the professional farrier. He knows by a glance at the upturned hoof how to make a shoe to fit it, and what size and length of iron should be cut off for the purpose. As the amateur has no experience to guide him, he must rest his practice on that of others, and should therefore work by rule.

The first rule to be observed is:—Make the shoe of B. B. H. Crown iron, of a size suitable to the intended weight of the finished shoe. Let this be as light as can be safely put on the hoof after carefully considering the work to be done by the horse. For instance, take a heavy dray-horse with a large hoof. The shoe for this horse must be stout to stand the wear and tear of heavy work on a hard road, and should be made out of $1\frac{1}{4}$ by $\frac{3}{4}$ inch iron. The shoe for a lighter cart-horse may be made out of 1 by $\frac{1}{2}$ inch iron; whilst that for a hack or pony may be as light as $\frac{3}{4}$ or $\frac{5}{8}$ inch. Of course, it is well-known that a light shoe can be forged out of heavy iron, but this should not be done if it can be avoided, since it involves a loss of material and labour. The required length of iron for a horse-shoe, may be determined in several ways, of which any of the following will be found practicable. 1. Take an imprint of the hoof on white paper, cut out the shape of hoof to size of imprint as for a paper shoe, double this, *i.e.*, fold one

part over another, and it will give half the length of necessary iron. 2. Take the cast old shoe if obtainable, or fit an old shoe to the hoof; double this to get half the length of iron required. 3. Measure the hoof across the widest part, and multiply by two to get the length of iron. For example, suppose the hoof measures 7 inches across its widest part, 7 by 2 = 14 inches, which will work out to 16 inches in the finished shoe.

The shape of the hoof should determine the form of the shoe. If the foot is well-shaped and furnished with a thick wall of horn, a plain shoe fitting closely to the wall at all points, and well rounded off at the heels should be prepared as shown at Fig. 112. This plain shoe should have its web as wide at the heel as at the toe; it must be as large as the hoof, not narrowed too much at the heels, well-seated and without calkins. If calkins are required, as for the hind feet of heavy cart-horses, then the iron should be upset to make the shoe thicker at the toe, and thus balance to a certain extent the raised heels. Calkins are the heel ends of a horse-shoe turned down to form two wedge-shaped heels intended to ensure a firm grip for the hind feet of cart-horses, as shown at Fig. 113. If the hoof of a horse is flat, and worn down very much, it should be provided with a hollow shoe—that is to say, instead of seeking to improve the shape of the hoof by making a thick and heavy shoe,

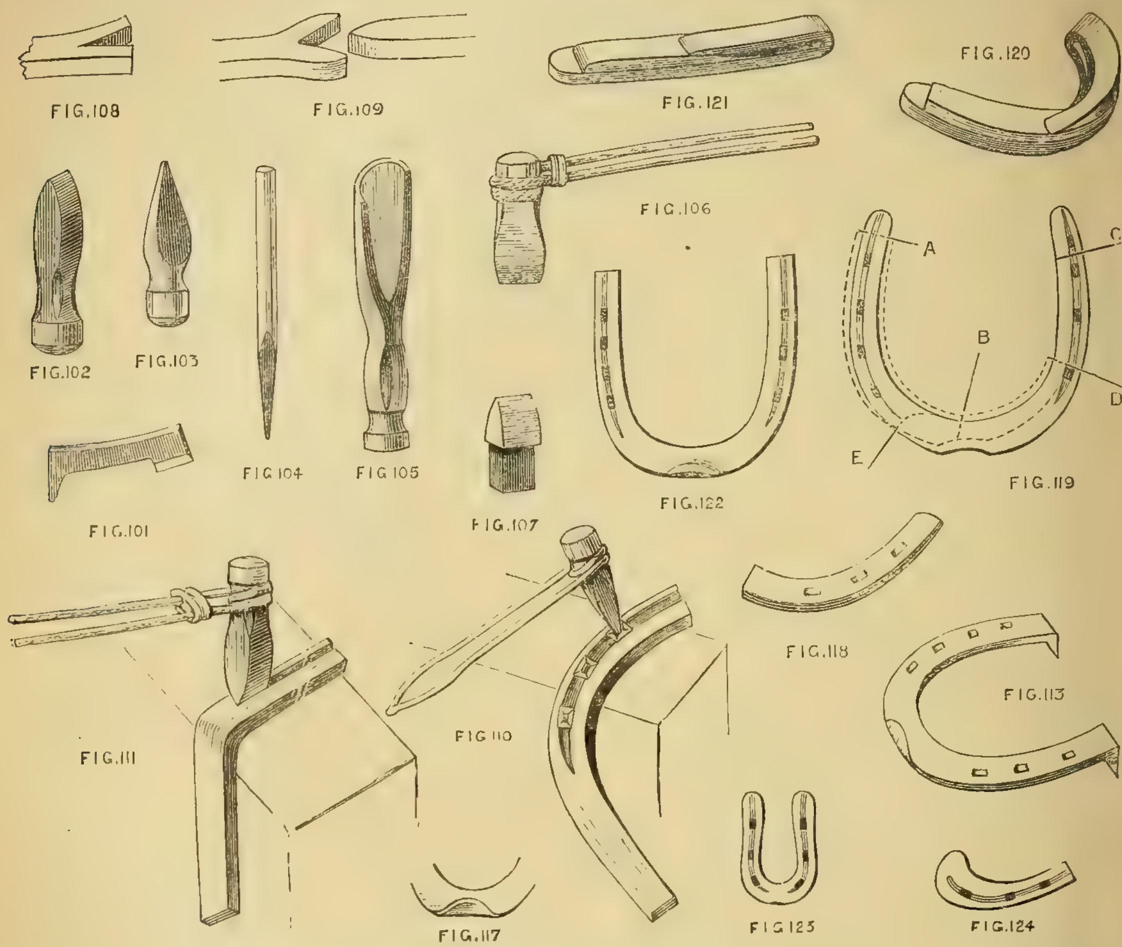


FIG. 101.—BUFFER. FIG. 102.—FULLER. FIG. 103.—PRITCHEL PUNCH. FIG. 104.—PRITCHEL. FIG. 105.—CURVED SETT. FIG. 106.—TOP HOT SETT. FIG. 107.—BOTTOM HOT SETT. FIG. 108.—BAR OF IRON CLEFT AT END TO FORM FORK. FIG. 109.—BARS OF IRON AND STEEL, CLEFT AND WEDGE-POINTED FOR WELDING. FIG. 110.—FIGURE SHOWING HOW TO COUNTERSINK NAIL HOLES IN HORSE-SHOE. FIG. 111.—FIGURE SHOWING HOW TO FULLER HORSE-SHOES. FIG. 113.—HIND SHOE FOR CART-HORSE. FIG. 117.—TOE CLIP OF HORSE-SHOE. FIG. 118.—HALF OF WORN SHOE. FIG. 119.—FIGURE SHOWING HOW TO WELD OLD SHOES TOGETHER. FIG. 120.—OLD SHOES FAGGOTED FOR WELDING. FIG. 121.—OLD SHOES WELDED READY FOR FORGING. FIG. 122.—FORGED SHOE BENT AND FULLERED. FIG. 123.—DONKEY-SHOE. FIG. 124.—OX CUE OR SHOE.

which would by its weight break away the already injured wall of the hoof, we must make the outer rim of the shoe to fit the wall, whilst the under or wearing surface is made broad to form a firm base as in the ordinary plain shoe. This is done by hammering the part intended to be left hollow, with the balled pane of the hammer, and thus making it as shown, Figs. 114 and 115.

one end of the shoe. This being done, proceed to "fuller" the half shoe by making a groove with the fullering swage near the outer edge of the shoe (as shown, Fig. 111) on the under surface, from the heel to a point near the toe, where it should stop, as shown, Fig. 115. This groove is intended to take the heads of the nails, and should therefore be made as near the edge as the nails will be required to be

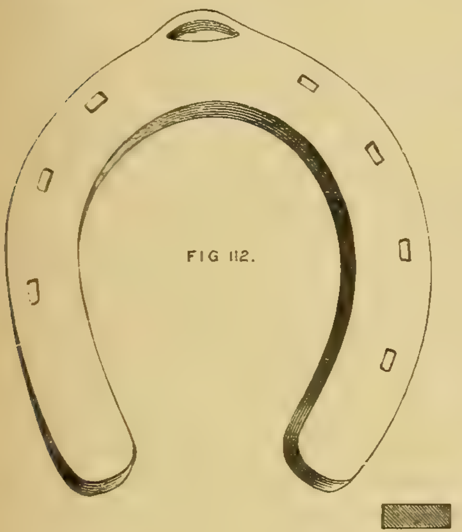
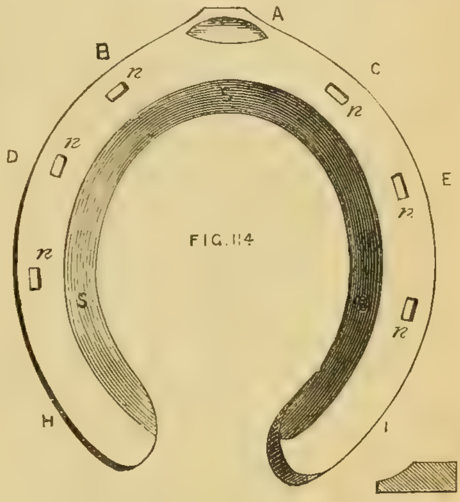


FIG. 112. — PLAIN HORSESHOE FOR HACK OR CARRIAGE HORSE.

FIG. 114 — MODEL SHOE FOR HACK.

A, Toe Clip.
B, Outer Toe.
C, Inner Toe.
D, Outer Quarter.
E, Inner Quarter.
H, Outer Heel.
I, Inner Heel.
S, Seating.
n, *n*, Nail Holes.



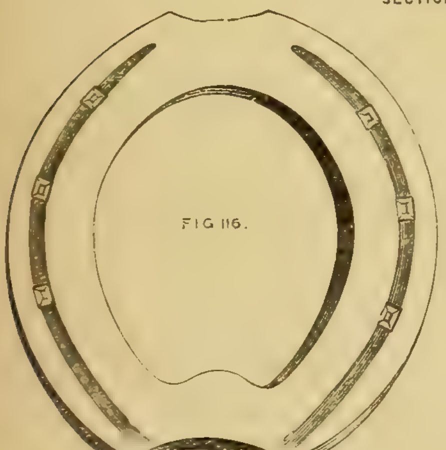
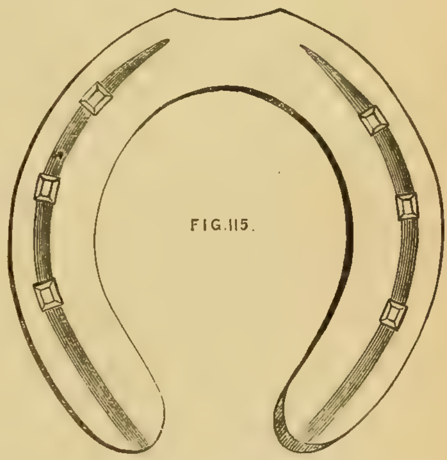


FIG. 115.—UNDERSIDE OF MODEL SHOE FOR HACK (FIG. 114) SHOWING THE FULLING.

FIG. 116. — ROUND SHOE FOR A LAME HORSE.



If a horse is tender footed on account of injury to the frog, or because of the presence of festering corns, it may be necessary to make a special shoe with a curved heel, or one in which the heels of the shoe are elongated, bent inward, and welded together at a point just under the cleft of the hoof, thus forming an almost round shoe as shown, Fig. 116.

The general shape and style of shoe having been determined, mark off the length on a bar of iron by picking it with a cold chisel, then proceed to forge

driven. The fullering must be done on a red-hot shoe, and by the aid of a striker who strikes the head of the fuller with a sledge whilst the smith holds the shoe with his left hand, and guides the fuller with his right. The fullering being done, the iron is cut off and held in a pair of tongs whilst the remaining half is forged and fullered. The toe clip is then made by hammering the red hot toe of the shoe, and turning it up over the edge of the anvil to the shape shown at Fig. 117. Then the holes for the nails (seven in

number, four on the outside, and three on the inside of the shoe) are punched, first with the pritchel punch (as shown, Fig. 110) to form the countersunk part of the hole, then cleared out with the pritchel to form the perfect hole. In making the holes with the pritchel punch, direct the tool so as to incline the holes inward near the toe and directly vertical near the heels. The heel holes must not be turned inwards on any account.

The shoe may now be finished to the required shape, and fitted whilst still hot to the horse's prepared hoof. By doing this the lumpy parts of the wall (if there are any) will be seared and marked, or any inequalities in the form of the shoe will be discovered, with the result in any case of enabling the workman to secure a perfect fit for the shoe. The contact of the hot shoe with the hoof may only be momentary if the farrier is smart, and in this short space of time no injury can be done to the hoof, or pain given to the animal. A good fit is most desirable, and when this is shown by a distinct impression of the red-hot shoe on the surface of the hoof all around, the hoof must be left with its marked under surface untouched, to come into contact with the shoe when cooled.

On the first trial of the hot shoe, it will be (probably) discovered that the heels are too long. The surplus metal should then be cut off with the curved sett, and thus leave the ends of the heels with a rounded contour, unless they are required for calkins. In this latter case, if there is surplus metal, cut it off with the wedge-shaped sett. When the shoe has been finished to shape and cooled, any little roughness may be touched off with a file, and the shoe again tried to the hoof by holding it with both hands—one on each side—whilst trying to look between the surface of the hoof and the shoe. If an appreciable space is discovered, the shoe must be made to fit by giving it a blow or two at the badly fitting part with a hammer on the anvil.

Since writing my first article on this subject, I have received a valuable communication from an aged country smith and farrier, who kindly warns me to impress all young beginners with a sense of the necessity to be careful in pointing the nails, and driving them into the horse's hoof. He says that "a great many young beginners spoil horses' hoofs by cutting away too much horn at the toe, and by this means cannot keep good feet on their horses, the animals as a consequence go lame and are tender footed. Young hands should be taught to leave nearly as much hoof at the toe as at the sides, and to leave hoof enough to keep the shoe up above the sole of the foot, and to hold the nails. They should point the nails by flattening them the contrary way to the flat of the nail, and then strike the point in a slanting direction to make it come out in the right part of the wall. If the point of the nail is left thin, it is apt to turn inward if it strikes an old stump or a bit of hard hoof." If the nails are well pointed, the nail holes properly made, and the hoof well prepared, there should be very little difficulty in nailing on the shoes, and getting good clenches on the nails. Experienced men can tell by the sound when a nail is properly driven. When they have all been driven and clenched, a few touches with the rasp around the hoof will remove all roughness and finish the job.

Some of the best horse-shoes, for wear on hard roads, are made from old shoes welded together. The best method for making new horse-shoes out of old ones is as follows: Take an old worn-out shoe and observe that one side is worn thin and light, whilst the other side is left thick and heavy. It will probably be worn very thin at the toe and will easily break in two across the toe. Break it thus (Fig. 118), and place one-half of it on the light end of another worn shoe, in the position shown by the dotted lines from A to B, Fig. 119; hold it in this position with a pair of tongs at E, get the parts at A to a welding heat and close them. Next, thin and point the heavy and thick part of the worn shoe from C, or the heel of the shoe, then bring the part D to a red heat and double the part C back upon the part E. The double shoe, with the additional half welded to it, should then resemble the form illustrated at Fig. 120. This must now be heated throughout to a white heat, straightened as shown at Fig. 121, and the whole well welded together. The short bar thus made up will furnish just the right quantity of iron for a new shoe, providing old shoes of sufficient weight have been selected to meet the requirements of the new shoe. In making the new shoe from old ones in this manner, the smith should proceed at once with the hot bar and form the toe of the new shoe first, then draw out one end and bend it, then draw out the other in the same manner, fullering and finishing the shoe in proper order, until it assumes the form shown at Fig. 122. It may be left thus, if not wanted at once, for it can easily be bent to the required shape whilst hot before fitting it to the horse's hoof.

By following the method given above, much fuel, material, and labour will be saved, and the work of the striker, or hammer-man, will be rendered lighter than when the three halves are merely doubled, welded, and forged down together.

The illustrations (Figs. 112, 114, 115, and 116) show some forms of horse-shoes likely to be of some use. Fig. 112 shows a plain shoe, suitable for a hack or carriage horse, or for a horse employed in the fields. This shoe is of light make, and is intended

for the off fore foot. When made for the near fore-foot, the four nail holes should be punched on the opposite side. Opinions vary as to the number of nail holes necessary to securely hold a shoe to a horse's hoof. Some farriers of the old school contend for eight, or at least seven holes. Modern farriers and veterinary surgeons lay down a rule in favour of the smallest number of nails possible, and hence reduce the *necessary* numbers to six and five. The ideal model shoe should be made light, tough, strong, and fixed without nails, or only enough to hold on the shoe. Fig. 114 shows the general shape of a good model, on the side next the horse's hoof, whilst Fig. 115 shows the same shoe, underside next the road. The "Round" shoe, Fig. 116, is made light, and is intended by its form to act as a protector to lame feet injured by corns. It is sometimes necessary to further protect the lame foot by putting a piece of thin leather over the surface of the underside of the foot, and nail the round shoe to the hoof over the leather sole.

Shoes for donkeys must be made of lighter iron than that used in horse-shoes. The nails are also smaller, and the holes and fullering adapted to the size of shoe. The general form is shown at Fig. 123. The treatment of the hoofs of asses and mules should be similar to that of horses. Those patient, lively, useful animals abundantly repay to their owners the cost of kind treatment, firmly and judiciously administered.

The use of oxen as beasts of draught and of burden, is not so frequent in England as it was some forty or fifty years ago; but their use is appreciated by our colonists in South Africa and elsewhere. I do not know how oxen are treated in other countries, nor whether they are shod or worked on their natural hoofs. In my young days when I learned to wield the ox goad, it was the general practice to protect the hoofs of working oxen with shoes of a shape similar to that shown at Fig. 124. They were made light—$\frac{1}{4}$ inch in thickness—lightly fullered and nailed. Oxen shod with "cues" on their cloven hoofs, will do good work in carts and waggons even on rough roads, and they are most invaluable animals for plough teams.

This last remark leads me to think that I must turn my attention in my next article to the work of making and repairing agricultural implements. Farming is not yet played out in this country, whatever some may think to the contrary, and it is well that all who farm on a small scale, whether amateur or professional, should have a few hints on the modes and processes they must adopt for making some of the more simple instruments they have to use, and repairing others of more elaborate construction.

(*To be continued.*)

A SMALL TOILET STAND WITH GLASS AND CUPBOARD.

By DAVID ADAMSON.

THE piece of furniture now described is just the sort of thing for a small bed-room or dressing-room, in which the ordinary toilet table too frequently usurps space that can ill be spared. The design is an eminently practical one, which can easily be carried out by any one possessing only moderate abilities in the cabinet-making line, the construction being very simple—in fact, attention to the accompanying illustrations almost causes further instruction to seem superfluous. As, however, this magazine is intended for amateurs who may not all be able to grasp the ideas so readily as a skilled mechanic, I venture to give such details as will enable even the beginner to get over any difficulty he may have in understanding the drawings. With ordinary care it will be found, I think, as easy to make as many of the little fancy articles in fret work. These, though very well in their way, are after all scarcely more than toys or ornaments; and many who confine themselves to this class of work, no doubt are apt to find that it becomes monotonous, and would willingly attempt something more useful if they were not deterred by want of knowledge how to set about it. To such I trust this paper may be helpful, and I don't think when they have made the stand they will regret the time and trouble expended on it. At the worst, it will be good practice for the novice, and the experience gained will not be lost. It will be noticed that the height differs considerably from that of an ordinary toilet table, this renders it very convenient as a shaving stand, under which name it is sometimes sold. The drawer under the top holds razors, brushes, and the usual toilet requisites, while the glass is raised sufficiently to allow it to swing without disturbing small things lying on top.

In setting out this design, the purpose of a toilet table having been carefully considered, leaves little to be desired. Variations can be made to adapt it to special requirements without materially altering the construction. For example, it can be made either higher or lower, two or three drawers can replace the cupboard, etc., etc. Such additions will readily suggest themselves to those requiring them, so they need not be further enumerated. I may mention that the side view does not profess to be a complete working drawing, as I have, for the sake of simplicity, left out the construction of the doors and similar details, and shown only what is absolutely necessary. Let me, though at the risk of repeating ad nauseam what I have said in former articles, impress the advisability

of making full-sized working drawings. Even for such a simple thing as this it will be desirable to do so, as a full-sized drawing, even if it does not contain all details, greatly prevents mistakes in measuring and cutting up wood. Details can easily be added as the work proceeds, though before actually beginning, it is always as well to have definite intentions of what the finished work is to be, in order to avoid incongruous ornamentation. It is immaterial what wood is used in the present instance, the design being equally applicable to mahogany, walnut, etc. Those who do not care to go to so much expense can make it out of clean, sound pine, and if it is intended to paint this, the beadings may be omitted without detriment to appearance. I may be pardoned just hinting that graining the paint will *not* improve the look of the stand. A plain self-colour will be most in keeping with its character. Graining, however well done, will give it a common, vulgar style, whereas a light French grey, say, either plain or relieved with pink or other complementary coloured lines, will have a good effect. To utterly spoil this, regarded from an artistic standpoint, paint a gaudy market-garden kind of nosegay on the panels and front drawer, with a few cabbage roses here and there on the ends, all in the realistic style. For this purpose, artificial flowers (?) from a cheap milliner's will serve admirably as models. Instead of being painted, the stand, if in pine, may be stained to imitate walnut, mahogany, etc., and be afterwards French polished.

With reference to painted furniture, an amateur friend having asked me how he could enamel pine work, it has occurred to me that others also might wish information about this finish. It is not a process suitable for amateurs, who however, can easily imitate it well by giving several coats of paint to the wood, and rubbing down all inequalities, such as brush marks, with fine glass-paper till a perfectly smooth surface is obtained. The work can then be finished by varnishing or polishing, with white polish only if the colour be light, and the result will be nearly equal in appearance to an enamelled surface, if sufficient care and labour have been bestowed.

For the ends or sides of the stand two pieces of inch stuff 3 feet 6 inches long by 1 foot 1 inch wide will be required. Probably these may require to be jointed to get the width. The most convenient place at which to effect the joint is shown by the perpendicular dotted line, A, Fig. 2, the reason being that the shaped pieces at top and bottom can be cut with very little waste, and joined to a plank 9 inches wide. It will also save labour in shaping the front. Of course, the edges must all be shot true, or the joint would have a bad appearance. Glue alone may be used, but a couple of dowels to each piece in addition will be better. The top, B, and bottom shelf, C, are of $\frac{3}{4}$ inch stuff, $12\frac{1}{2}$ inches wide (back to front) by $16\frac{1}{4}$ inches long each. Under B is the lining, D, the same length, but only 3 inches wide. The width of this may vary from an inch or a couple of inches less to anything not wider than the shelf above it. It is simply employed to make the top appear more massive, and if preferred, it may be left out altogether. E is a similar piece, and the same remarks apply to it, except that it *must* be used, though it may be set back behind the drawer front, which will be deeper accordingly. F and G, the top and bottom of the cupboard, are two pieces of equal size, the same length as B, C, D, and E, but only $8\frac{1}{2}$ inches wide. They may be the same thickness as the others, but as a little variety looks better, and there is no necessity for them to be so thick, I have shown F as $\frac{5}{8}$ inch, and G as $\frac{3}{4}$ inch stuff. To prevent confusion, I may say that the thickness given in each instance is that of the wood in the rough, so that when worked up, all will be a little thinner, and due allowance must be made for this throughout.

It will be noticed that I have given the lengths of the wood for the shelves, etc., as $16\frac{1}{4}$ inches, while the drawing shows only 16 inches between the ends, and it may be as well to explain the reason for this. A neat workman need only make them 16 inches long, but as I assume that all amateurs are not sufficiently expert to bring the ends of shelves close throughout up to the ends of the stand, the extra $\frac{1}{4}$ inch is allowed for sinking the shelves into grooves $\frac{1}{8}$ inch deep cut into the ends. This, to a certain extent, will compensate for want of skill in squaring off, and is also quite as legitimate a form of construction as the other, only it involves a little more work. Fig. 1, by the dotted lines at ends of shelves, shows what is meant, the depth of grooving being slightly exaggerated for the sake of clearness. It will be understood that the grooves must not come right to the front of the end pieces, but stopped say $\frac{1}{4}$ inch back, and that the grooving may be a little more than $\frac{1}{8}$ inch deep. Dowels, or mortise and tenon may be used to attach the shelves to the ends. The former possibly involve less work, and in this instance will do quite as well as the other, especially if the shelves be sunk into the ends as recommended. Do not glue up till the job is further advanced. Another way to fix the shelves is simply to screw them from the outside of the ends, sinking the screw heads well, and covering the holes with turned buttons, Fig. 3. Yet another, simpler still, but not so reliable, nor so neat, is to fix the shelves by blocks glued under them. It will have been noticed that the shelves are $\frac{1}{2}$ inch less from back to front than the ends. This is to allow for the backs, H, being sunk flush with the edges of the end pieces. They are of $\frac{1}{2}$ inch stuff, and may, without detriment, be

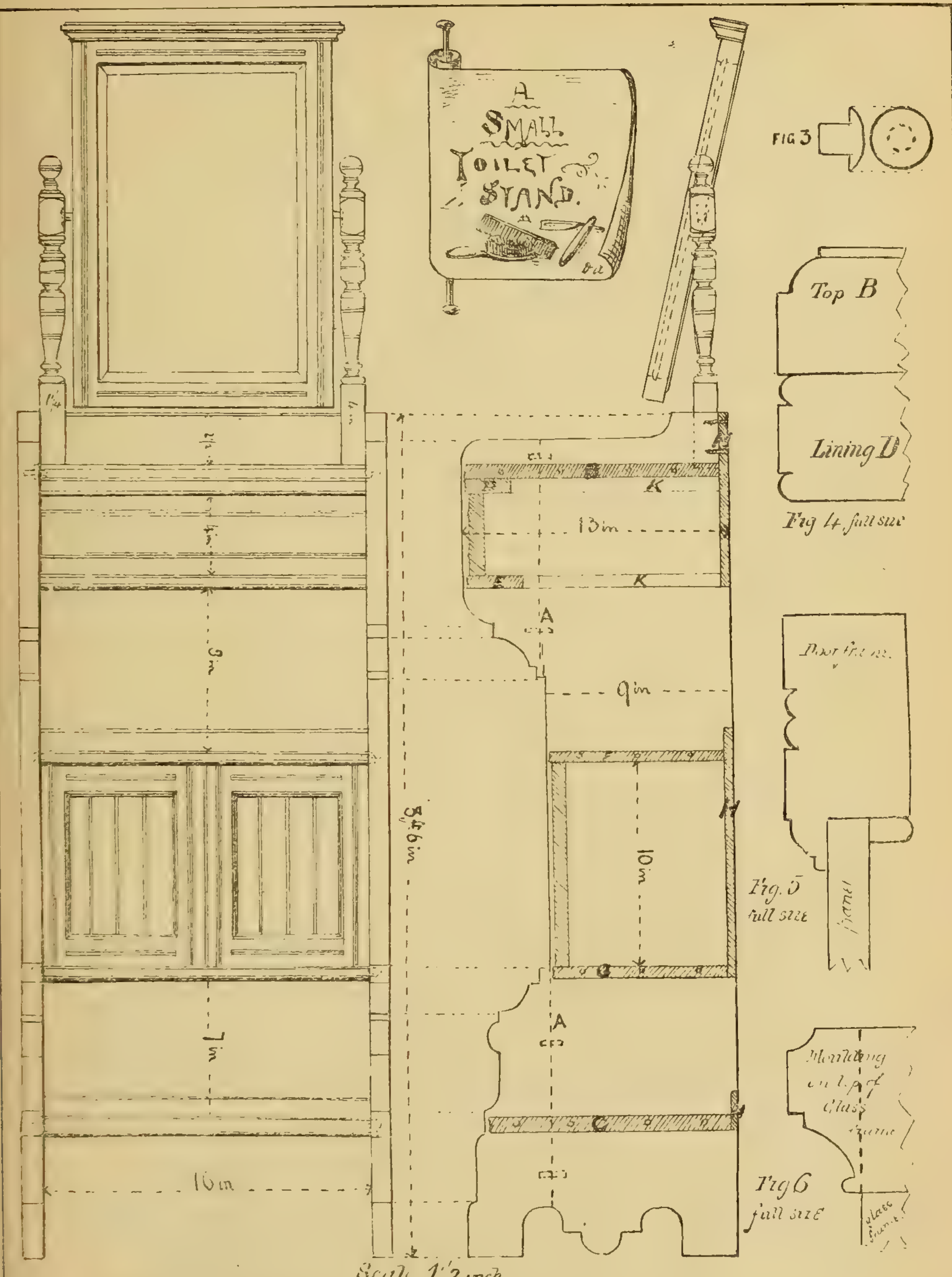


Fig 1 Front Elevation   Fig 2 Side Elevation

pine, or some cheaper wood than mahogany, walnut, etc., if the work is being made in these, except the parts above the shelves, which being visible, should be of the same wood as the shelves. I merely mention this small economy in material in case of the maker having slips suitable for these back-guard rails by him handy, as the amateur would waste more in time than he would save in wood, by cutting specially. The backs may be either dovetailed to the ends, the lap dovetail of course being used (see "Every Man His Own Mechanic"), or what is much simpler, and in the present instance, equally good, rebates may be sunk in the ends for the reception of the back pieces. A few screws will hold these.

To prevent mistakes being made it may be as well to state that rebates are cut in ends only where the backs fit in—*i.e.*, the rebates must not be run from top with the plane. If they are, then they should be filled up where not containing the back, by slips glued in and trimmed flush. K, K, the slides for the drawer, may be fitted any time after the exact position of D and E have been determined on. They are simply pieces of wood of ½ inch to 1 inch square from D and E to the back. Is it unnecessary to say that these must be precisely parallel, or the drawer, however accurately made, will not run accurately and smoothly? The carcase, or lower part, may now be fitted together permanently, when the drawer and doors may receive attention. Neither of these will require detailed instructions being given, as the construction of a drawer can easily be seen by looking at one, and Fig. 5 shows the section of the doors clearly in full size. The only remark it may be necessary to make with regard to these is that the top and bottom rails of the framing are let into the uprights, not the uprights into them. The frame may be best fixed by mortise and tenon, the moulding being mitred. The standards for supporting the glass are 16 inches long, of 1¼ inch squares. They should be turned in some neat pattern, as indicated on sketch, three or four inches at the bottom being left square, as well as pieces about two inches long, a couple of inches below the top of the knobs, which are only for the sake of giving a finished look to the columns. If the lower ends of these are correctly squared, a couple of screws in each from the back will suffice ; but perhaps it will be better to sink the ends slightly into the top B. Fig. 2 shows this distinctly. The glass frame still remains to be made. Its construction is exactly the same as the door frame, only, as shown, it is without the moulding on the inner edges. I should say that the wood for this frame must be thicker than that for the door frames ; 1¼ inches will do very well, as the rebate must be deep enough to receive the glass and the blocks for holding it. The cornice or moulding above the glass frame, Fig. 6, may be either fastened by screws on to the top of the frame or stuck on to the face of it with glue, as shown by the dotted line. If this be done, the upper rail of the frame must be proportionately wider, and the ends even with the top. In this case the ends of the moulding should be mitred, in the other they may be either mitred or worked. Before the glass is fixed in the frame should be hung, or rather the glass movements which allow it to swing should be fitted. The best movements to use are known as "the patent." Several sorts are patented, but they go under special names, and the one I refer to is that generally used. They can be got from any cabinet ironmonger's, and should be of good quality, as many of the cheaper makes are very inferior, only fit for the lowest class of "slop" goods. The difference in price between a reliable pair and the commonest, is not great. An examination of the movements will show how they work better than any written description, and it will be almost impossible to make any mistake in fastening them to the frame and pillars. The upper squares in these were left for one part of each movement, the corresponding part being let into the frame from the back and side just above the centre, in order that the upper part of the glass may not have a tendency to topple over. The parts of the movements fixed to the pillars may be sunk as far as needed. The glass should have a bevel edge, and the size of plate will be 16 by 11, though till the frame be made it will be hardly safe, in case of a misfit, to order it, as a very trifling error in the size would either hide too much of the bevel or show the rough edge of the glass. In former papers I have fully described the process of blocking in the plate, so I need not recapitulate it here ; but bear in mind that for a bevelled edge glass the plate should be ⅜ of an inch each way more than the sight size. The cost of 16 by 11 silvered plate of best quality, with ¾ inch bevel, will be about 5s. 3d. The glass at the back must be protected by a thin wood panel, either sunk into the rebate or screwed on to the frame. Polishing may be proceeded with as usual, and when it is done, I think a piece of furniture very satisfactory both to the maker and any one using it will be the result. A few words as to the beadings I have shown.

These must be taken not as absolutely necessary to be followed, but as indicating the parts where they are an improvement on plain edges. Though simple, they are quite in harmony with the work, and it does not follow that because others are more elaborate that they are therefore handsomer ; indeed, it is often from the judicious use of simple lines that the most pleasing effects are obtained. To the amateur designer I would say, do not strive to cram in as much

ornamentation as you can, but endeavour to make the most of constructive lines. A piece of furniture may be plain, but it does not follow that it is on that account ugly. This quality which is not generally sought after, is frequently the result of elaboration without the necessary knowledge of the principles of design, and is obtained by the very means that are in error taken to avoid it. This working on simple and constructive lines is the keynote to the much spoken of, but little understood, "Art Furniture" of the present day. Carvers may wish to put some of their handiwork *en évidence* in this piece of work, and if so, I should be sorry to discourage any from doing so by implying that there should not be any; on the contrary, the appearance of the work may be increased by carving the panels say—a carved pediment might also be added to the glass frame. Heavy carving in a realistic style would be, however, quite out of character with the rest of the design almost as much as painted nosegays. With these suggestions I conclude.

PRACTICAL SCENE-PAINTING FOR AMATEURS.

By HENRY L. BENWELL.

XVIII.—HOW TO PAINT, ARRANGE, AND WORK A TRANSFORMATION SCENE—PANTOMIMES.

IN "the good old times" Pantomime scenery and effects were very different from those which are now presented to our view, at all the large theatres which still produce this class of entertainment. Indeed, the extraordinary improvements made year after year in the general "get up" of pantomimes are apparent to the most naked and unpractised eye.

"That portion of the public who 'sit out' the time-honoured pantomime, and are dazzled by the glittering wonders of the ever-vernal transformation scene, are perhaps, in an odd moment, induced to ask what is the meaning of, or whence might have originated, these triumphs of scenic, artistic, and mechanical display? Such enquirers would doubtless be surprised to learn that the old adage to the effect that 'There is nothing new under the sun,' applies with equal force to pantomimes in general and to transformation scenes in particular, as to many other common things around us." *

The origin of our modern transformations is to be sought in connection with the ancient Roman Theatre. The scenic and mechanical appointments of the great theatre of the Empire, although more rudely constructed, were in every detail as complete as are those of our own day.

In the ancient tragedies most elaborate mechanism was made use of in order to obtain supernatural effects: gods in chariots would descend from above, heroes would ascend to the realms of bliss on the backs of eagles, and demons consigned to the burning regions beneath.

In place of these heroes and goddesses peculiar to the ancient drama, substitute the fairies that are year after year discovered in a transformation scene, with their picturesque groupings, and movements from unseen directions into mid-air, in front of our modern pantomime audiences, then the origin and significance of all the stage carpentry of to-day will be at once understood; and with this knowledge we can proceed with the next stage of our enquiry—the introduction of pantomimes into England and the working of present-day transformation scenes.

During the reign of James I. that ancient spectacle, the Court Masque, was first introduced into this country. "But while the public theatre continued long in this contracted state," writes Isaac D'Israeli in "The Curiosities of Literature," "without scenes, without dresses, without orchestra, the Court displayed scenical exhibitions with such costly magnificence, such inventive fancy and such miraculous art, that one may doubt if the combined genius of Ben Johnson, Inigo Jones, or Lawes, or Feroboco at an era most favourable to the arts of imagination, has been equalled by the spectacle of modern opera."

Inigo Jones was the leading spirit, the only one who had sole control of these productions, for was it not he who invented all the architectural embellishments and the machinery for working them, without which the Masque would have been a mere nothing in the eyes of our forefathers.

These entertainments of the Masque order contained the exact elements of a modern transformation scene—namely, in the gradual changing of one scene into another, and the discovery of fairy occupants of leafy bowers and airy heights to the strains of low and melodious music, and assisted by a perfect blaze of illumination, and the most costly costumes that art could design or money procure.

In 1656 Sir William D'Avenant breaking through the tyrannical rule of the Puritans made a successful attempt to re-introduce the drama under the disguise of "an entertainment of music and declamation," he followed up the success of this strategic performance by an English opera, *The Siege of Rhodes*, followed again by *Psyche*. In the latter production there were not only employed scenic effects on the most extensive scale, but a series of changes of a mechanical order copied from the Court Masques of the time,

* "The Stage," December, 1883.

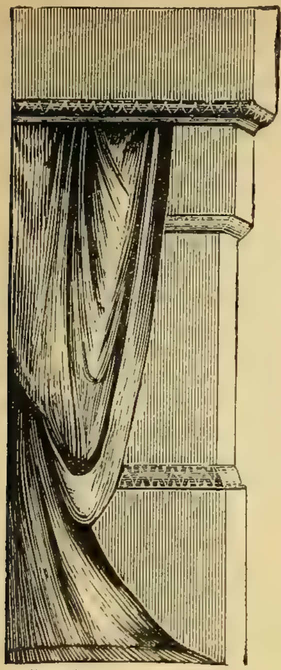


FIG. 87.—PROSCENIUM WING, R.

and similar to the transformation of our own pantomimes. The best idea of the similarity between the operatic displays of the past and the fairy mechanical scenes of the present, will be at once conveyed by a description of the final tableaux of D'Avenant's *Psyche* :—

"Cupid flies away, the garden and palace vanish, and Psyche is left alone in a vast desert upon the brink of a river, full of willows, flags, and bulrushes. Psyche despairing, contemplates casting herself into the river. But the god of the river arises from the water and commands her to desist. Jupiter descends on an eagle from above, and, at the intercession of Cupid, raises Psyche to a place among the immortals." Other similar effects followed.

But the first recognized English pantomime was placed upon the stage by John Rich, at Lincoln's Inn Fields Theatre, on December 26th, 1717, and entitled *Harlequin Executed.* In 1758 Joseph Grimaldi came on the scene and quickly distinguished himself by the invention of pantomime tricks and machinery, and afterwards as a clown.

Coming nearer to the present day, Mr. Leopold

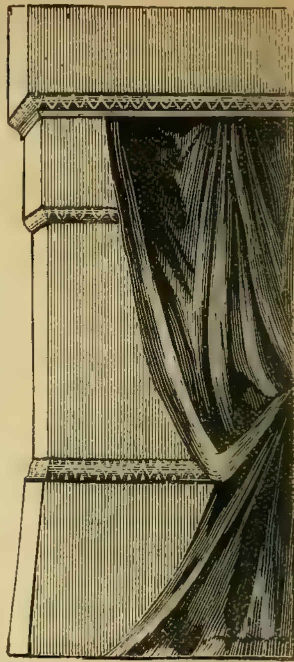


FIG 87A.—PROSCENIUM WING, L.

FIG. 86.—FIRST, OR "FAN" CLOTH.

FIG. 88.—SUBJECT WING, R.

Wagner, speaking of *Transformations*, says, "We have it upon the authority of Mr. Planché that those were almost entirely due to the skilled efforts and successes of Mr. William Beverley, who, in the matter of extravaganza so impressed the public with his fine talents as an artist upon theatrical canvas, that gorgeous scenes became quite the rage, and how, year after year, Mr. Beverley's powers were taxed to the utmost to outdo his former triumphs, and how the most costly materials and complicated machinery were annually put into requisition until the managers themselves began to suffer."

It will be evident to all readers—and especially to those who take an interest in and watch the pieces of the day, as they are produced—that this condition of things has undergone a steady increase until at the present moment it is quite impossible to conjecture even where all the gorgeous splendour and mechanical completeness of our annual transformations may lead us to; or whether

FIG. 88A.—SUBJECT WING, L.

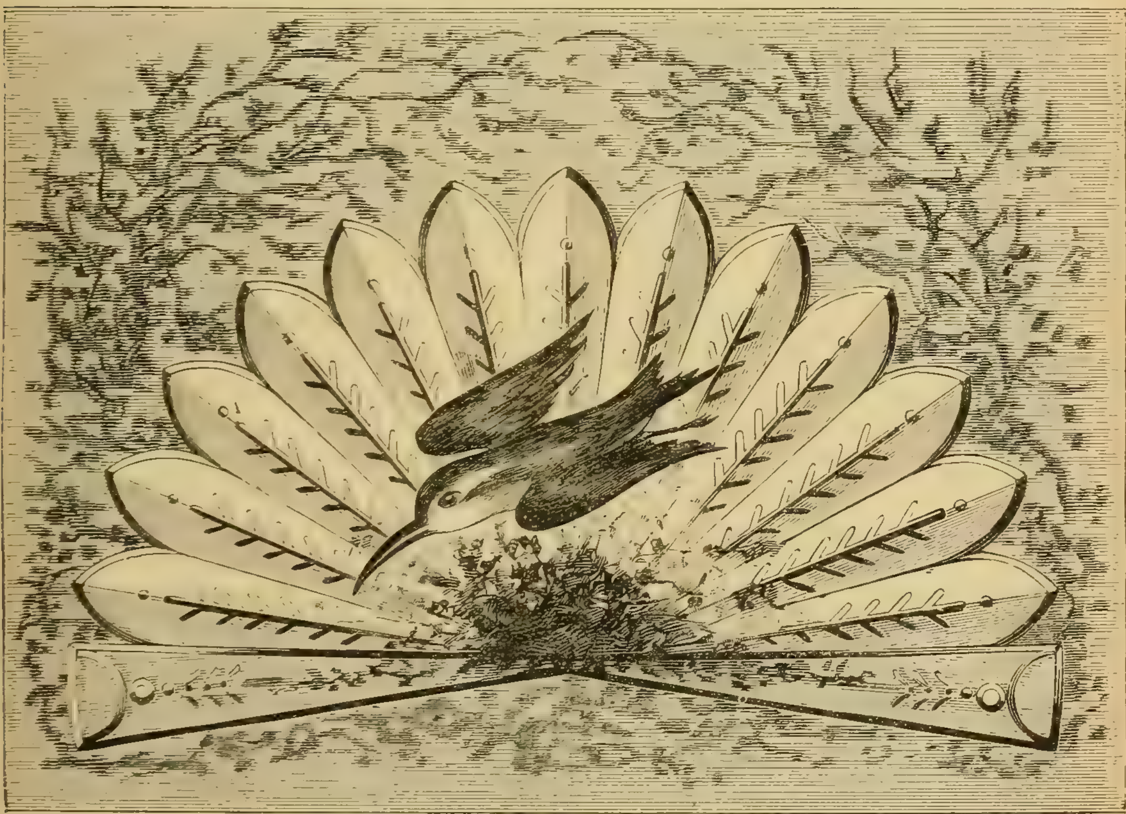


FIG. 89.—SECOND, OR "KINGFISHER" CLOTH.

we shall ultimately be compelled to fall back upon the simple story, dramatically told and prettily enacted for the more especial entertainment of our young folks, than a continuance of our present incongruous programme, the end of which only serves to show how scissors and paste can be brought under rule—in the transformation.

These remarks of Mr. Wagner's are somewhat severe on our hard-worked scenic artists who, to say the least, are deserving of all praise. Mr. J. R. Planché and Mr. W. Beverley have certainly done more for English pantomimes than all the rest of the profession put together, and it is entirely due to the latter gentleman that we owe our transformation scenery of the present day.

"All will recall in some elaborate transformation scene how quietly and gradually it is evoked. First the 'gauzes' lift slowly one behind the other—perhaps the most pleasing of all scenic effects—giving glimpses of the 'Realms of Bliss' seen beyond in a tantalising fashion. Then is revealed a kind of half glorified country, clouds and banks evidently concealing much. Always a sort of pathetic, and at the same time exultant strain rises, and is repeated as the changes go on; how we hear the faint tinkle—signal to those aloft on the 'bridges' to open more glories. Now some of the banks begin to part slowly showing realms of light with a few divine beings—fairies—rising slowly here and there. More breaks beyond and fairies rising, with a pyramid of these ladies beginning to mount slowly in the centre. Thus it goes on, the lights streaming on full in every colour and from every quarter in the richest effulgence. In some of the more daring efforts the *femmes suspendues* seem to float in the air or rest on the frail support of sprays or branches of trees. While, finally, at the back of all, the most glorious paradise of all will open, revealing the pure empyrean itself, and some fair spirit aloft in a cloud among the stars, the apex of all. Then, all motion ceases ; the work is complete ; the fumes of crimson, green, and blue fire begin to rise at the wings ; the music bursts into a crash of exultation ; and, possibly to the general disenchantment a burly man * in a black frock coat steps out from the side and bows awkwardly. Then to a shrill whistle the first scene of the harlequinade closes in and shuts out the brilliant vision."†

Such is a general idea of a *transformation* as described by one of the most fluent writers on stage matters of to-day. I will again quote shortly from this same authority—to whom I must acknowledge my indebtedness, and then discourse from my own pen on a transformation scene in general. From these remarks therefore, the reader should be perfectly able at a future date to originate, paint and work a *transformation*, quite independently of the instructions and designs which it will be our pleasure to give in the next chapter, for painting a simple subject. To proceed, "The ingenuity exhibited in the aerial displays—girls apparently floating in the air at great heights—has to be supplemented by extraordinary precautions to prevent accidents. These 'irons,' as they are called, to which the performers are strapped, are made of the finest, best tempered steel, and their shape must be ingeniously contrived to supply strength in company with the artistic requirements. This element is generally secured by extending them below the stage in the shape of long levers, which take their share of the weight. But large platforms, or 'equipments,' as the French call them, are the essential of every 'transformation,' consisting of a vast stage rising slowly from below, and suspended by ropes and counterpoises, and so nicely balanced that a couple of carpenters can raise them, although burdened by a score of *figurantes*, each strapped to her iron.

"This is the principle which underlies all these effects, but it is infinitely varied, and there are even platforms upon platforms which rise in their turn after the first has arisen. Thus allusion has been made to the 'crowning of the edifice,' at the close of the transformation, when, perhaps, a semicircular group of fairies will rise, and from out this group a central figure will mount slowly, becoming the apex, as it were, of the whole. Then it will be noted that the semicircle begins to open, the group to separate, and the figures to glide down and forward by some mysterious agency. It is contrived by ingenious machinery called by the French a 'parallèle.' This consists of a number of light pedestals, about 12 feet in height, which are ranged closely around a centre pedestal, the tops being drawn close to it by cords brought down and secured to a windlass worked by a man who ascends with the machine. At the proper moment he 'lets go,' and the weight of the figures, checked by the counterpoises, allows the pedestals to open out, exactly as the ribs of an umbrella would do. The whole machine is complete in itself, and is kept 'in stock,' and can be fitted to many varieties of effect."

Transformation scenery largely depends for its aerial and dreamy character suitable to its sentiment, upon being executed in very light colours whereby greater contrast is secured between them and the scenes of our more humble sublunary sphere or those wherein the evil personages of the supernatural world have their abiding places. The painter should also use the purest possible colours and tints, otherwise when the different coloured foils are laid on the scene,

* The Manager or Lessee.

† Percy Fitzgerald, "Behind the Scenes."

it will look faded and dirty, and the colours lose much of their effect. Grey is a good colour for backgrounds and for showing up bright colours.

Mr. F. Lloyd, a celebrated scene-painter says, "Fairy scenes should be painted in the lightest possible manner, so as to have, especially in the middle and extreme distances, that airy, dreamy, and indefinite look about them, so well exemplified in the beautiful pictures of Turner. Study closely these wonderful creations of his, and you can scarcely go wrong."

Transformation scenes, as a rule, should commence with almost utter darkness, the lights gently rising before the first change is made, so that the first cloth may be seen distinctly by the audience; the stage continues to get lighter and lighter, and the scene ends with the greatest possible lightness which can be produced by the painter, added to which are the Dutch metals, foil paper, spangles and logies, all displayed under the illumination of the limelight and coloured fires.

The pupil's *transformation* should always have one central and principal object during each change, which attracts and retains the eye of the spectator, and each successive change should also be of a brighter and more elaborate nature, till the climax arrives, filling the stage with glow and glitter, with floating fairies, and every part of the scene one blaze of light and delicate brilliant colours.

(*To be continued.*)

CIRCULAR SAW BENCH,

WITH PLANING, GROOVING, REBATING, AND MORTISE-BORING ATTACHMENTS.

By OLLA PODRIDA.

V.—Use of Circular Saw for Ordinary Work—Of "Drunken" Saw for Grooving and Rebating—Planing—Mortise Boring, etc.—Conclusion.

IN addition to the instructions already given for the construction of this machine, a descriptive catalogue of the different classes of work which may be accomplished with its aid, and how they are to be carried out, may be of value in many cases. It may also be the means of conveying to intending builders some encouragement and assurance that their labour will not be unsatisfactorily expended. Each class or species of work will be taken separately, and the method of procedure fully described in detail.

Circular Sawing.—The machine is intended to carry an 8 inch saw, but saws of lesser diameter may be used if convenient. Some care should be exercised in the choice of the saws. They should be of moderate thickness, so as to guard against buckling or springing, and possess a good open tooth with plenty of "set." A saw of this description will run much lighter, and thereby carry a far better cut, as far as speed goes, than a thin springy article with fine teeth. Of course, such a saw would be suitable only for general work in the roughing-out line. For finer work, such as picture framing, a thin saw with fine pitched teeth would be required. A suitable thickness for the first-mentioned would range from $\frac{1}{32}$nd to $\frac{3}{64}$ths of an inch, and the pitch of teeth should be about half an inch.

The ordinary processes of ripping and cross-cutting require no remark further than a passing caution against driving the work too hard on the saw. A steady uniform pressure, just sufficient to keep the teeth occupied, is all that is required, and in the long run, far more satisfactory than spurts of heavy pressure, which only clogs the teeth, and prevents the saw from obtaining its proper clearance due to the "set," with the direct result of great loss of power and efficiency, together with the danger of buckling and spoiling the tool. In order that a circular saw may be used to the best advantage, it is essential that it should run truly in every direction. If the periphery is out of truth, the work is unequally divided amongst the teeth, with the danger of bending the spindle; if out of truth sideways, power is lost through unnecessary friction against the work while being cut, and in either case the quality of the work will suffer.

In rebating, the table must be raised and packed up by wedge pieces until the saw stands through and above the top a distance equal to the depth required. This must be tested, to ensure correctness, by running a waste piece of stuff over the saw. The fence must then be brought up and set to the saw by measurement from the front of fence to the left-hand side of teeth, according to width of rebate. This should also be checked for width by trial before venturing on work. Two operations will complete each piece. For instance, take a piece of framing which is to be rebated. Let us suppose that it is 2 inches square, and that it must be rebated out to $\frac{3}{4}$ inch wide, by $\frac{1}{2}$ inch deep; then the saw would first be set $\frac{1}{2}$ inch above the table top, and the fence brought up to $\frac{3}{4}$ inch from the outer or left-hand side of saw teeth. This would then be verified by trial. The stuff would then be passed over the saw, and kept firmly down upon the table, and close against the fence, during its passage. The rebate is then complete as far as width goes, and if there are other similar pieces to be treated in a like manner, and to the same dimensions, they should all be operated upon before altering the setting of saw and fence. The next business is the

cutting and finishing of rebate to depth. To do this the table must be lowered until the saw stands up $\frac{3}{4}$ of an inch, and the fence set back to a distance of $1\frac{3}{8}$ inches from the *right*-hand side of saw teeth ; the result in this case being also verified before entering upon the completion of the work. In all cases the stuff must be planed up square before rebating for convenience in carrying out the latter operation.

There are other classes of work which may be accomplished in a satisfactory manner by means of the circular. The members of Oxford frames may be let into each other, and the rebates, except for a little finishing at the ends, cut. For rebating such frames a small saw should be used, one about $2\frac{1}{2}$ inches in diameter would be useful, as the smaller the saw is the closer it can be run to ends of rebate without cutting past the notches. In making the notches for letting in the members of such a frame, it is convenient to clamp two together and cut them both out at one operation. Of course, the sides form one pair, and the top and bottom another. A little practice will enable the operator to run close to the lines, and leave little for paring.

The ordinary moulding for picture frames may also be mitred on the circular with the assistance of a mitre box used in conjunction with the flat edge fence shown on the left for planing. The construction of this box, and its application, will be clearly understood on reference to Fig. 57. It should be made of hard wood, and in cutting the moulding a fine toothed sharp saw about 8 inches in diameter should be used.

The shoulders of tenons may also be cut by using a guide working between the two fences, the saw being set so as to cut a depth equal to the thickness of material to be removed. The tenon itself may also be roughed out by running a number of cuts across, being afterwards finished by the paring chisel with better results than could probably be attained by a novice in the art of using the tenon saw.

For thicknessing stuff, the circular is also very useful and expeditious. For instance, supposing we have a piece of wood of any length, and say 6 inches wide, by 1 inch thick, and that it is required to reduce it to $\frac{3}{4}$ inch thick. Then by setting up the fence to $\frac{13}{16}$ or $\frac{7}{8}$ inch from the right-hand side of teeth, and passing the stuff through twice edgeways, an eighth of an inch or so of superfluous material will be removed, and a considerable amount of "slogging" plane work dispensed with. For this purpose, the saw should be a tolerably stiff one with a good sharp "set" on the teeth.

Drunken Saw.—If a tolerably stiff saw has been chosen for the ordinary circular work, then the same saw may be employed in an intoxicated state, but one about 4 inches in diameter would be best, as it need not be larger in diameter than necessary to accomplish a fair depth of grooving or rebating. With a sharp stiff saw a groove about $\frac{1}{2}$ inch deep by $\frac{1}{2}$ inch wide may be accomplished at one cut, but by taking two bites at a cherry a deeper and wider groove may be managed.

The "drunkenness" of the saw is regulated by the relation of the two bevelled washers, and the amount required for a specific purpose must be ascertained by actual trial on a waste piece of timber. If too little, then the thick sides of the washers require to be brought more opposite to each other and *vice versa.* A little experimental practice with these washers will be found of great assistance.

In cutting grooves, it will be of assistance to employ both of the fences, setting them at the proper distance from each side of the saw, according to the required position of the groove in the stuff. In cutting rebates one fence can only be used, and this had better be the right one. If it is required to cut a wide rebate, it can readily be accomplished in two or even more operations by shifting the fence according to requirements. It must be borne in mind that the "drunken" saw must be kept well set and properly sharpened, in order to get the best work out of it.

Planing.—In starting the planing business, the first thing is to see that the cutters are properly sharpened to a fine razor edge. A nice flat oil-stone is necessary for this, it being important that the edges of the cutter should be straight. Patience must be exercised in bringing up the edge to a thin true keenness. A thick edge got up in a hurry is of no use whatever, being only likely to spoil the work, so that a little extra time spent on the oil-stone will be well invested.

In setting the cutters, a piece of wood planed up flat will be required. This must be laid across the opening in gap, and the edges set carefully to the under surface of the wood until they touch equally and evenly on each edge. As the setting approaches satisfactory completion, the nuts must be gradually tightened up until when properly set they are rigidly screwed up.

The cutters will run towards the operator, and the fence on the right must be brought up, and slightly over them, so as to cover the right-hand cutting corners of the tools by about a sixteenth of an inch. The block and spring for holding down the work must be set down so as to throw a pressure on the stuff. For instance, supposing the stuff to be planed is 2 inches thick, then the spring must be set down within about one inch and a half or so from the table top, but the requisite amount will be more readily ascertained by trial. If too tight, it will be difficult to feed the work over the cutters, and if too slack, the

work will be jarred up and down. The under sides of the ends of spring must be kept moistened with oil, to facilitate the passage of the work over the cutters. A light cut is preferable; two light cuts will be found more satisfactory in point of quality and speed than one heavy one. For the satisfactory execution of work, it is necessary that the machine stands firmly upon the floor, so as to be quite free from tremor or shake. In all cases, whether using the saw, planer, or boring apparatus, the bearings must be well oiled and running freely.

The small auxiliary planer-tool provision on the end of the cutter block will be found useful in many ways. Beading may be accomplished with its aid and a suitably formed cutter. The edges of blind laths may also be rounded off. The male members of dovetail groove joints may also be cut with the left-hand fence set up close as a guide.

Mortise-Boring, etc.—The term, as applied here, does not mean the cutting of mortise holes, or finishing them off in the machine. It refers to the lessening of labour upon them by boring only. For instance, supposing it is required to cut a mortise $4\frac{1}{2}$ inches long by 1 inch wide. For this, the procedure would be as follows: Mark out the mortise with a centre line running lengthways; at each end describe an inch circle, and, equally between these two end circles describe two others. Take an inch centre-bit, and bore out to these marks. The stuff left between the holes can be readily removed with a sharp chisel, the diameter of the holes being a good guide for the truth of the sides. In setting for boring, the work must be laid upon the slide, Fig. 3, and against the shoulder, Fig. 6 (see Folding Sheet to Part 54); this done, the rest must be adjusted until the point of centre-bit corresponds with the centre line of the mortise. It being necessary that the operator should stand in front of the tool with both hands free, assistance for "treadling" will be required.

The centre-bits may be held in chucks made of hard wood, screwed direct on the nose of spindle. They—the chucks—should be as short as possible, say two inches long, and about two and a half or three inches in diameter. They may be made by boring a hole $\frac{11}{16}$ of an inch in diameter by 1 inch deep, into the faced side of a suitable piece of beech, which must then be firmly screwed on the spindle, and turned up in place by means of a temporary rest, attached either to the cross-piece, C, or to the boring rest, B R. A small hole must then be bored through the centre, and squared out to suit the shank of centre-bit.

The shoulders (6, 6, Fig. 4) of the rest may be varied at will, according to necessity, and the upper faces of them should always stand well above the centre-bit or drill. In addition to the boring of wood, holes up to $\frac{3}{16}$ inch in diameter may be drilled in metal work, provided the tools are kept sharp. In all cases, while using the boring end of the machine, the loose collar at C on the spindle (see Folding Sheet, Part 54) must be kept well oiled.

In addition to drilling and boring, a moderate amount of turning in the shape of chuck work may be accomplished at the end of the machine with the assistance of a wooden face chuck and a temporary rest. The face chuck should be about one and a half inches thick, and may easily be made in the same

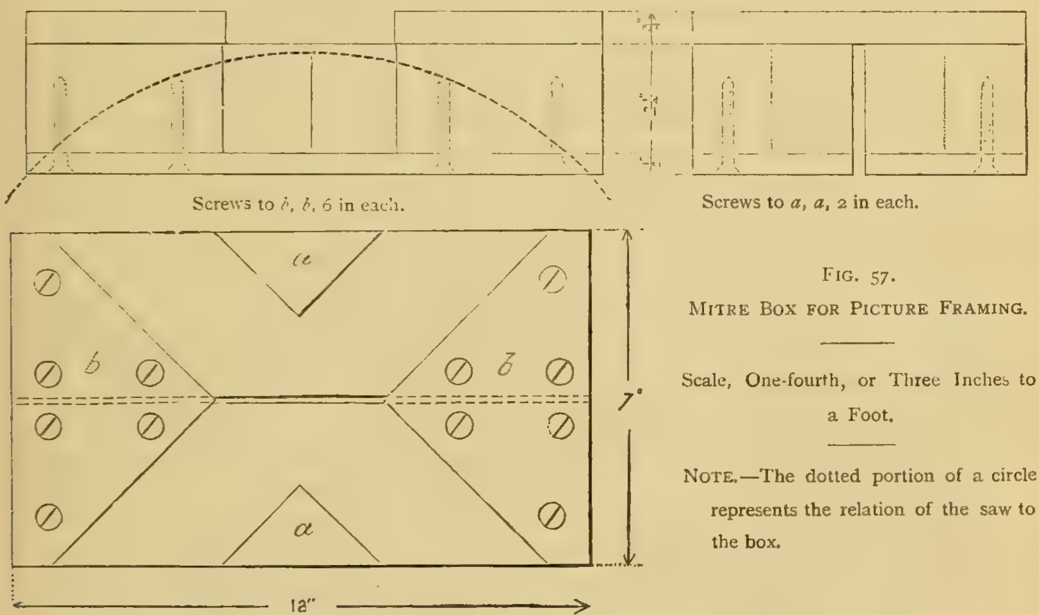


FIG. 57.
MITRE BOX FOR PICTURE FRAMING.

Scale, One-fourth, or Three Inches to a Foot.

NOTE.—The dotted portion of a circle represents the relation of the saw to the box.

manner as the one for holding bits, with the addition of a metal washer nailed or screwed on the back to shoulder against the collar or spindle. After it has been faced and turned in place, a small hole suitable for a $\frac{5}{16}$ inch or $\frac{3}{8}$ inch wood screw must be bored in the centre, and the screw, which should be about one inch long, driven in from the back until it projects beyond the face of the chuck about half an inch. Two of these chucks will be handy, one about three or four inches in diameter, and the other about eight inches. With the latter, a round table top 2 feet in diameter could be o-gee'd or moulded on the edge, and the sand-papering and polishing carried out with ease.

If the amateur likes to fit this end with grinding or polishing apparatus, it can easily be done, but I cannot advise the use of such. The bearings would suffer heavily, and once they became badly worn, constant trouble would ensue.

If a cast iron flywheel can be obtained, so much the better. One suitable for a flat belt would be preferable, but failing that, a grooved one may be used, the only objection to the latter form being that the table would have to be raised higher to clear the cone pulley while cross-cutting timber of any length greater than the table width, and the attendant disadvantage of this would be a reduction of the effective depth of saw.

In conclusion, I may add, for the benefit of those who may undertake the construction of the machine, that I shall be happy to supply any further assistance, should it be required, and this at any time through the medium of "Amateurs in Council."

THE REFLECTING TELESCOPE:

ITS CONSTRUCTION AND MANUFACTURE.

By EDWARD A. FRANCIS.

XIII.—AN EASY FORM OF MOUNTING THE MIRRORS—THE CONSTRUCTION OF THE EYE-PIECES.

IN these pages, where so many excellent lessons in carpentring have been given, it would be superfluous for the writer of this paper to instruct his readers in the art of fitting together the various parts of the easily constructed mounting described last month. He will content himself with recommending that the diagrams in the last issue should be carefully studied, in conjunction with the brief details of construction and engravings of certain portions of that mounting which are now about to be placed before the reader.

First shall be completed the box (Fig. 79) which is to carry the eye-piece and the arrangement for focussing. This box may be made of four pieces of well-seasoned wood, free from knots or defects. When completed it should be about nine inches square.

The general appearance of the completed mounting is shown in Fig. 86, and as the relative positions of the various parts were before given in Fig. 85, no difficulty whatever should be met with in its completion.

The grand aim of the constructor should be to secure certain conditions, to wit: First, that the mirror cell should be so placed that the speculum will lie vertically to the surface, and at right angles to the edge of the base-board; second, that the tube containing the flat should be fixed concentric with the circumference of the great speculum; and, third, that the eye-piece tube should be fixed exactly at right angles to the eye of the base-board, and exactly opposite the flat, which latter, by the way, will, if properly fixed, appear as a circle when viewed without any eye-piece through the eye-piece tube.

It is very possible that some slight adjustment in the position of that tube will be afterwards found necessary. To provide for this, it is advisable to cut a larger aperture in the side of the box than is absolutely necessary—say, one of 3 inches in diameter. The eye-piece tube may then be separately mounted on a square piece of $\frac{1}{2}$ inch mahogany, which may be secured to the box by four ordinary screws, as in Fig. 87. By this means, having first by measurement fixed the speculum and flat in their correct relative positions, the wooden slab containing the eye-tube may be adjusted centrally with the flat (that is, with the eye-tube pointing directly at the flat), and so fixed. Any slight adjustment may then be made by loosening the necessary screws and packing the mahogany slab up with a thin slip of wood or card.

It is evident that it may be necessary to vary the size of the aperture for the eye-tube according to diameter of the collar in which that tube slides; and here it may be mentioned that the diameter of the outermost eye-tube need not exceed $1\frac{1}{2}$ inches—indeed, if the primitive focussing slide indicated in Fig. 84 is to be adopted, the aperture will only need to be of the same measurement as the external diameter of the tube that is to work in it.

The method of fixing an eye-piece into the eye-tube so as to secure correct centring is shown in Fig. 88, in which A A is the sliding tube of the focussing apparatus; B B a ring of wood turned to receive about two inches of the tubing into which the eye-pieces will slide (the tubing equal to D, in Figs. 89 and 92); and C C, an eye-piece in position. Even when expense is no object, it is convenient to fit each eye-piece into a short length of tubing of a given size, which will slide easily into a fixed tube (as D, Fig.

88) in the focussing mount; by this means, one eye-piece may easily be substituted for another in the darkness—a positive advantage on frosty nights, when the fingers are numbed with cold or enveloped in thick gloves.

Having arranged all this, the eye-piece box may be placed temporarily in position, the flat mounting, Fig. 78, being fixed within it, equidistant from either side, and pointing straight down the base-board to the great speculum. It is essential that the centre of major axis of the elliptical mirror shall be, when all things are completed, exactly as high above the base-board as the central point of the speculum.

The adjusting screws in the back of the speculum should be carefully rounded at the points, so that they may work easily and freely on the back of the speculum, which they should touch through three holes of any convenient size cut through the felt bed upon which the mirror rests. If required, the cell might be made with a closing lid to protect the mirror when it is not in use; otherwise, the latter will require to be removed after every series of observations.

The speculum may be secured in its cell by packing with folded paper, but it should be held only just tightly enough to prevent side movement.

If all has been correctly attended to, and the reason of things considered during the manufacture, the telescope should now be ready for use, save that the eye-pieces are missing. These we will now show how to construct, abstaining, however, from all theory, since the lenses may be purchased very cheaply indeed.

A simple astronomical eye-piece costs, if purchased at a trustworthy optician's, from fifteen to twenty-five shillings. Those we shall describe, costing but two or three shillings, and demanding only exact attention of the very simple rules of construction, will perform equally well with the best ordinary eye-pieces.

Two forms will be considered, the two most common forms, both of which retain the names of their respective inventors. They are the Ramsden and the Huyghenian eye-pieces. The former is shown in section in Figs. 89 and 90, the latter in Figs. 92 and 93.

The Ramsden eye-piece is composed of two plano-convex* lenses of equal focal length, placed at a distance apart, of one-third of that focal length, and connected by a tube. Such lenses as will be required may be obtained at prices varying from sixpence to two shillings, according to the whim of the seller, and can be very easily mounted in the manner indicated, especially if the amateur possesses a lathe. Indeed, if the latter be the case, the plan illustrated and explained in Figs. 90 and 93 may be followed, although no special advantage will accrue therefrom. When purchasing the lenses the reader should be quite sure that they are edged correctly, that is, that the edges have been ground away in a lathe truly, and, if possible, vertically to the plane side of the glass.

We will describe fully the construction shown in Fig. 89, assuming first that the amateur is aware that if brass tubing cannot be obtained, a tube formed of successive layers of paper cemented around a wooden rod of the required diameter, and when dried, slipped off the rod, may be substituted.

The two lenses, A A (Fig. 89), should be purchased, each 1 inch in focal length, and about $\frac{3}{4}$ of an inch in diameter. Next obtain a length of brass tubing, B B, of such a size that the lenses will exactly fit it, and also a second length of smaller tubing, C C, which will fit tightly, telescope fashion, inside B. Cut off from the tubing, B, about $1\frac{1}{4}$ inches. All the cutting must be truly performed, so that the edges may be perfectly flat and form a right angle with the side of the tube. From the smaller tubing, C, cut away three rings, the first $\frac{1}{4}$ of an inch, the second $\frac{2}{3}$ of an inch, and the third as the first, about $\frac{1}{4}$ of an inch in depth.

The depth of the second ring it will be noticed is equal to two-thirds of the focal length of either lens, so that, if placed between them it will separate them to the required distances. The tubes may be nicely cleaned up, and the interior of the smaller ones blackened, the interior edges of the $\frac{2}{3}$ of an inch length being slightly bevelled to set against the convex surface of the lens.

Into one end of the tube B, fix the first quarter inch length of smaller tubing, having its edges cut (or ground) perfectly true and flat. This may be either soldered or cemented in position. Upon the edge formed by this combination, place one of the lenses plane side downwards. The two-thirds length of tubing slipped in next will retain the lens firmly in position. Now drop in the second lens, convex side downwards, and upon its plane side rest a disc of card equal in diameter to the lens, and having a central circular aperture of about $\frac{3}{16}$ of an inch (E, Fig. 91). Finally, the insertion of the other $\frac{1}{4}$ inch ring of tubing will complete the construction of the eye-piece, which will correspond exactly with Fig. 89. If all the cutting has been carefully performed, an excellent eye-piece will have been made at a minimum cost. To adapt such an eye-piece to the eye-tube of the telescope, a narrow collar, D, of a still larger sized tubing should be soldered on to B as shown. A comparision of Figs. 88 and 89 will then indicate how the adaptation is performed.

* Flat on one side and curved on the other, as A, Fig. 91.

The professional method of mounting is indicated in Fig. 90, and that so distinctly as to require little comment here. The greatest skill is requisite in preparing the ledges in the castings B B, on which the plane side of the glass is bedded. The lens is retained in position by a thin wall of brass which is first cut around the ledge, and then burnished over while the glass is held in position.

The Ramsden eye-piece is in reality a small microscope of considerable power, as may be easily demonstrated by the curious reader. It is known commonly, as the positive eye-piece. In the Huyghenian eye-piece the image viewed is formed *between* the lenses, in the Ramsden outside them, and this fits the positive eye-piece for many uses, to which the other form (called the negative) cannot be adapted. If for example, two spider lines or hairs be placed crosswise and fixed at such a distance from the eye-piece that they may be viewed distinctly, they will, when the eye-piece is used in the telescope, appear coincident with the object under examination, as if they were actually drawn on it, and thus many important measurements can be made. Of this, more will be said when the construction of the finder is being described.

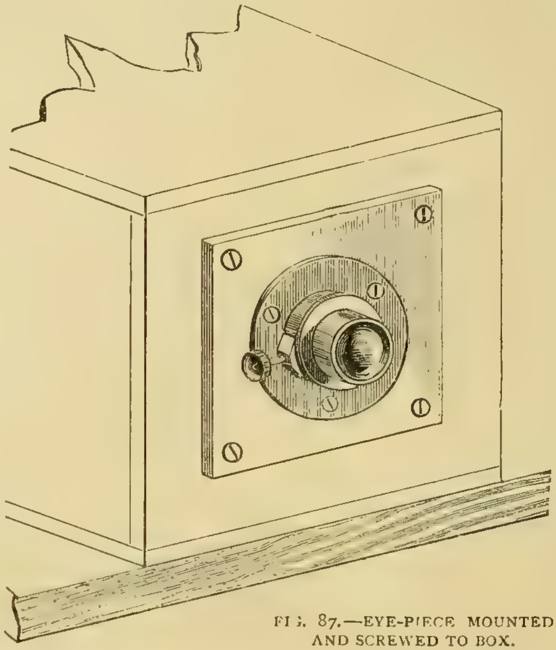


FIG. 87.—EYE-PIECE MOUNTED AND SCREWED TO BOX.

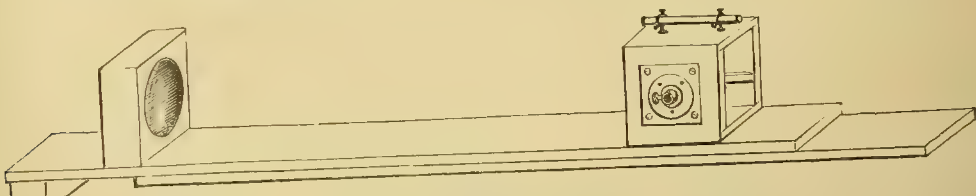


FIG. 86.—GENERAL APPEARANCE OF MOUNTING WHEN COMPLETED.

As it is desirable to have the lenses of an eye-piece as thin as is consistent with perfect action, and as the thickness depends upon the diameter, the first or eye lens, the Ramsden, may be of a lesser diameter than the field lens (about one-half of the latter), in such a case, the method of mounting the eye lens will be similar to that shown in Fig. 92.

The magnifying power of any Ramsden eye-piece varies with the focal length of its component lenses. Thus, an eye-piece formed of lenses, each 2 inches in focal length, would have less magnifying power than that we have just constructed, in which the lenses are but of 1 inch focal length. It will be as well here to enunciate the following rule. The magnifying power of any eye-piece is found by dividing the focal length of the great reflector by the focal length of the eye-piece.

If the latter, for example, consisted of a single lens of 2 inches focal length, then its power on a telescope having a great speculum of five 5 focal length, would be

$$\frac{5\text{ft. or }60\text{inches}}{2\text{ inches}} = \frac{60}{2} = 30;$$

that is to say, the object to which the telescope was directed would be magnified thirty diameters, or just over nine hundred times superficially. But in the case of the Ramsden combination we have two lenses; and before we can calculate the power of the eye-piece we must ascertain what would be the focal length of an equivalent single lens. This may be done by the aid of the formula that here follows :—

$$\frac{f^2}{2f - a}$$

where f—the focal length (equal) of the lenses, and a the distance between them. In our eye-piece just constructed this becomes

$$\frac{1^2}{2 \times 1 - \frac{2}{3}} = \frac{1}{1\frac{1}{3}} = \frac{3}{4} \text{ of an inch.}$$

So that an eye-piece formed of two lenses each of one inch focal length, placed at a distance from each other equal to two-thirds of that focal length would be equivalent in magnifying power to a single lens of $\frac{3}{4}$ of an inch focal length, and on our 5 foot reflector would magnify $60 \div \frac{3}{4}$, or eighty times.

The same rule applies regardless of variation in the

focal length of the component lenses, so long as they are equal in that respect. If for any experimental purpose it is desired to form a Ramsden eye-piece of two lenses of unequal focal lengths, the equivalent single lens may be ascertained by substituting the following formula for that previously given :

$$\frac{f1 \times f2}{f1 + f2 - a}$$

In this case the terms have the same relation as previously, f 1 and f 2 being the foci of the two lenses, and a the distance of separation.

It will be seen that the amateur now has it in his power to construct a Ramsden eye-piece of any given strength, by working backwards as it were, and this remark well applies also to the Huyghenian eye-piece, the construction of which we will now consider.

It may have been mentally asked, "Why should we not use a single lens?" and the answer would be, "For much the same reason that we should not view through a common prism any object which we wished to distinctly define."

The single lens breaks up the light rays and refracts them, so that a star appears as a brilliant chromatic coruscation, and any larger object distorted and fringed with colour. The same effects are slightly observable at the edge of the field of view of an ordinary compound eye-piece, and more so in the Ramsden than in the Huyghenian. For this reason the latter is often spoken of as the *achromatic eye-piece.* Latterly, opticians have constructed eye-pieces in which each lens is in itself compound and achromatic, but the construction of those we shall not consider—indeed, the common compound eye-piece is that most generally used; and if carefully made, it furnishes excellent definition.

The lenses of the Ramsden eye-piece were of equal focal lengths, those of the Huyghenian are unequal in this respect. Whatever those focal lengths may be, if they preserve in their relation to each other the ratio of 1·3, and are separated by a distance 2, the resultant eye-piece will be a success. Plano-convex lenses must again be used.

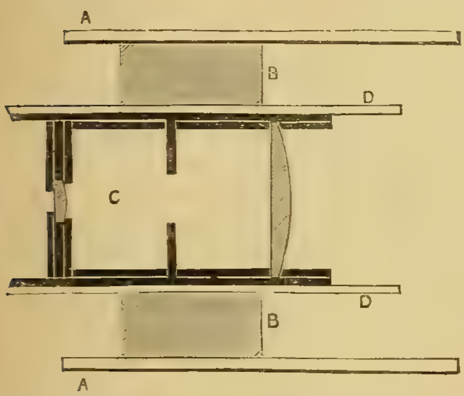


FIG. 88

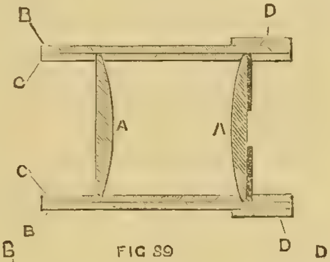


FIG 89

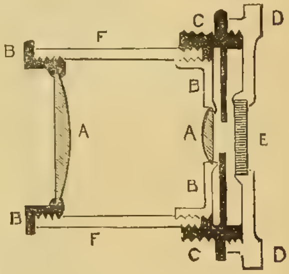


FIG 90

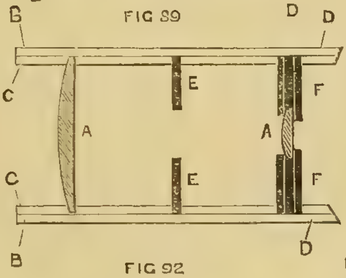


FIG 92

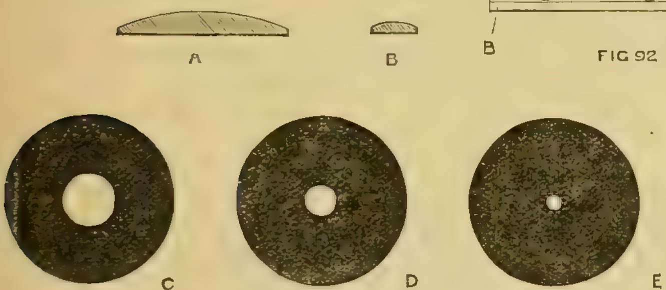


FIG 91

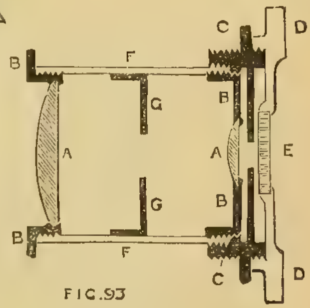


FIG. 93

FIG. 88.—MODE OF FIXING EYE-PIECE TO SECURE CORRECT CENTRING.—A, Section of Tubing; B, Section of Wooden Ring; C, Eye-piece; D, Fixed Tubing for Eye-piece C. FIG. 89.—RAMSDEN EYE-PIECE SIMPLY MOUNTED. FIG. 90.—RAMSDEN EYE-PIECE COMPLETELY MOUNTED.—A A, Lenses in B B, Brass Mounting; C C, Metal Disc with Eye-hole; D D, Sunglass Cap, containing E, Sunglass. The whole combined by Main Tube, F F. FIG. 91.—HUYGHENIAN EYE-PIECE.—A, B, Sections of the Lenses; C, D, E, Perforated Disc of Card or Metal. FIG. 92.—HUYGHENIAN EYE-PIECE SIMPLY MOUNTED (SECTION). FIG. 93.—HUYGHENIAN EYE-PIECE COMPLETELY MOUNTED (SECTION).—A A, Lenses in B B, Brass Mounting; C C, Metal Disc with Eye-hole; D D, Sunglass Cap containing E, Sunglass. The whole combined by Main Tube, F F. G G, Perforated Metal Disc to limit Field.

For example, if an eye-piece be formed of a small lens of one inch focal length, and a larger one of 3 inches focal length, and the two glasses be placed 2 inches apart, a good Huyghenian or negative eye-piece will be the result.

The lenses of the Ramsden it will be remembered, were placed with their convex sides turned towards each other; in the Huyghenian the plane side of each lense is turned towards the eye. Let us proceed to construct an eye-piece of this kind. Obtain two lenses, the one of one-half inch, the other of one inch and a half focal length. These will require to be placed one inch apart. The longer focussed or field lens, may be about three-quarters of an inch, the shorter but little more than a quarter of an inch in diameter. Tubing, such as was used for the Ramsden, will be required. Of the tubing B, cut $1\frac{1}{2}$ inch length; of the tubing C, which fits with B, cut as follows: One piece $\frac{1}{4}$ inch deep, two pieces $\frac{1}{2}$ inch deep, and one piece of the depth of $\frac{3}{16}$ of an inch.

Procure, also, four discs of good black cardboard or soft brass, less than $\frac{1}{16}$ inch thick, and of the same diameter as the larger lens. In two of these (B C, Fig. 91) cut or drill central circular apertures of the exact diameter of the small lens; in the third (D, Fig. 91), an aperture slightly ($\frac{1}{16}$ inch less); and in the fourth (E, Fig. 91), drill a tiny hole scarcely more than $\frac{1}{8}$ inch in diameter. The lenses (A A) are also shown in Fig. 91.

In addition, a ring of the tubing D should be cut. The eye-piece may then be constructed by referring to Fig. 92. To the tube B first solder the collar D. Next solder into position the smaller $\frac{1}{4}$ inch interior collar, which should be bevelled slightly on its interior edge to accommodate the convex glass. The field lens may next be placed, convex side downwards, upon the bed thus prepared for it, and secured into position by the insertion of one of the $\frac{1}{2}$ inch lengths of tubing, C. Next drop in disc B, Fig. 91, and here it may be observed that the greatest care should be taken to have the central aperture of this disc clean cut. The insertion next of the second $\frac{1}{2}$ inch length of tubing C, will render all, so far, secure. Now place in disc D, Fig. 91, and upon the bevelled edge of its central aperture rest the convex side of the small eye-lens. The fixing of disc C will centre that lens with respect to the tube. Finally, the last disc E may be placed over the plane side of the small lens, and the whole held in place by fixing the remaining piece of the smaller tubing in position. It may be necessary to cement this latter to the outer tube. The eye-piece is now finished.

Looking through this eye-piece, apart from the telescope, the aperture in E F, Fig. 92, should be beautifully defined. If this is not so, the section of tubing C, between that stop and the eye-lens may require to be removed, slightly cut down, and replaced.

The power of the single lens equivalent to any Huyghenian eye-piece may be found by the use of the second formula quoted for the Ramsden eye-piece. If the proportion one and three is maintained in the focal lengths of the lenses employed, the power of any Huyghenian eye-piece or any telescope may be roughly ascertained by dividing the focal length of the great mirror by one-half the focal length of the field lens of the eye-piece.

A little careful manipulation may be necessary to fix the small lens satisfactorily. Any soldering that may require to be done should be completed before the lenses are placed in position.

The perforated disc E E, Fig. 92, was not necessary in the construction of the Ramsden eye-piece, because in that eye-piece, as already stated, the focal image in the telescope is magnified outside of the eye-piece; whereas, in the Huyghenian, the image is formed between the lenses, and the stop E E is used to limit the field of view to a circle of good definition. The eye hole, F F, Fig. 92, is used in both cases. It simply directs the eye—how it may be placed at once in the most advantageous position for viewing any object.

The adjustment of the telescope, without which it is useless, but which is very easily performed indeed, I will describe in my next paper.

One word of warning must be given to any inquisitive amateur who may seek to test his telescope meanwhile, and that is, not to turn it on to the sun. No common dark glass will serve to shield the eye from the sunlight concentrated in such a large instrument. The method of using the telescope for sun work will be hereafter briefly touched on.

With reference to the eye-piece mounting. If the telescope-maker is a clever fitter, he may make the eye-tube slab so that it may be fitted on either side of the box. This will save him from having to assume some awkward positions when observing—for the flat can be easily rotated, if truly mounted, so as to reflect the cone of light in any direction.

The *professional* form of mounting the Huyghenian eye-piece is shown in Fig. 93, and is self-explanatory.

I do not think that anyone who goes to work with a will, and a desire—nay, a determination to succeed—will find much difficulty in mounting the telescope and in making and mounting the eye-pieces described in this paper. I can only say, as before, that my services, through the Editor or in Amateurs in Council, are always at the disposal of amateurs who may require further aid.

(*To be continued.*)

THE SMOKER'S COMPANION.

A USEFUL AND ORNAMENTAL SPECIALITY IN FRETWORK.

By A. GEBHARDT LAKER.

(*For Illustrations see the Folding Sheet issued with this Part.*)

BUSINESS over for the day, mind and body want relief. What shall I do? This is the question which naturally suggests itself, and the answer invariably is the same: Follow the old programme items, of course: a stroll, or, perhaps, a friendly game of billiards; look in at a theatre or a concert, a chat with Brown, a little music with Smith, etc., etc., concluding with the homeward journey at a very respectable hour.

Such is the life of the easy-going individual who treats the cares of the world lightly, spends his income as quickly as it is earned, sees no danger clouds looming in the distance, and is determined if life is to be short it shall be a merry one.

Only 10.30 p.m., arrived home rather early to-night, capital, now for a quiet half-hour or so, a smoke, a read, and, perhaps, a little toddy before retiring to rest. A very good resolution, but one not always so easily carried into effect. Frequently the cries are—Where is my pipe? Who can have taken to-day's paper or my book away? Where has my tobacco been put? What! all the cigars gone? No spills! Why not? Empty bottle, of course, and no glass! Yes, these are a few of the many questions which suggest themselves to the uncared-for bachelor who prefers plodding, or is compelled to plod, life's journey without the soothing and untiring attention of that almost indispensable companion, woman. Ladies who do not possess the above-named qualifications must please not simper and regard the appreciative remarks as applied to them, as any visionary conjugal felicity would soon be dispelled when practically tested. Something of this sort would happen: Storms would threaten, develope, then burst in full fury upon a defenceless shore (allowing that the wife and little ones are *alone*), and the breakers (of furniture, etc.,) would strike greater terror in the household than the mighty waves to the helpless mariner. It being my misfortune, or fortune, whichever it may be after what has just been depicted, to be a bachelor, the questions suggested as above had so often pressed themselves upon me that I was tired of the repetition, so much so, in fact, that I determined to design some shapely article which would accommodate this (to smokers) useful and essential collection. As few, if any persons, like cumbersome-looking things, I have endeavoured to make the combination as small as possible.

At a glance it will be seen that what is called the "Smoker's Companion" contains a rotary cigar stand, spill holder, newspaper rack, tobacco drawer, pipe-rack, and receptacles for bottle and glass. Now all these smoker's indispensables being kept in such a small space, if the owner has only the bump of order (if that is the proper phrenological definition) moderately developed, his landlady, female progenitor, aunt, and the domestics, will be spared a great many black looks and unpleasant controversies, besides, there will be no necessity for the upholsterer's presence. It is to be lamented that some of our abstaining friends (for whom I have great respect) will undoubtedly shudder when they see the *dreadful* (?) bottle, more especially when they read its label. Let them be assured that it (the bottle) is quite harmless, and however long they inspect the drawing no intoxicating influence will be felt. Raspberryade, gingerade, lemonade, and all other ades, can be kept ready for the use of those who aid the temperance movement, equally as well as the alcoholic drinks for non-abstainers. Like many others, I was, at an early age, induced to acquire the habit of smoking by an old and intimate friend, who was a great lover of the weed. After several unsuccessful attempts to look happy and feel comfortable, I could begin to understand the enjoyment which he had so often expressed he experienced, and now I imagine it my duty to initiate others that they may participate in the pleasures derived from the habit. As some persons, perhaps, have an idea that smoking is necessarily attended with a liking for drinking—not water, cold tea, or cocoa, let it be understood, but alcoholic drinks—it is only fair to state that some of the most inveterate smokers are of the most temperate habits, and even total abstainers. If there are any very young readers of AMATEUR WORK they may, of course, *look* at this month's Supplement, but they must be good boys and keep it until they have attained such years that will warrant their doing anything further. It being taken for granted that this Supplement will be issued in the winter months, when indoor occupation is most acceptable, I have, disregarding the multiplicity of holes for the fretsawyer, designed the *Companion* with a view of making a strong and unbreakable pattern that can be dusted without fear. Offering a sincere apology to any readers to whom the introduction may have been tedious, I will at once give a few comments upon the article to be constructed.

The outside of the back measurement being about twenty inches by nineteen inches, it will be an advantage, perhaps, to some "cutters," to have it arranged for working in sections. Accordingly, it is divided into three pieces. The kind of wood must, of course, be decided upon by the amateur; but some light

colour would look well, and contrast with the various things placed against it. The pattern is a well-laced one, but to prevent disappointment by breakage, the ornament might be cut in $\frac{3}{8}$ inch stuff, except where otherwise marked.

Lower portion, or base of design, is a semi-hexagonal figure, enclosed, with drawer in the centre for tobacco, and places for bottle on the left, and for glass on the right. So far, the pattern is alike each side ; the inequality in size of bottle and glass, however, causes a change in the next storey. To keep the former steady (not because it contains inebriating influences) it is necessary to have a corner shelf, by which the leverage is reduced. The glass will only appear a little above the second floor, so the panel at the back of it instead of being plain, is ornamented. Two division pieces or brackets are placed above the base, one forming the support to the corner shelf just alluded to, the other being to balance the appearance and to enclose the rotary cigar stand, which is erected in the centre. Another use of these brackets is that they bind the back and base together. Sections A and B are intended to be glued together and then fixed, by pipe-rack being screwed to them, on each side of the separating lines. A little glue can also be put upon that part of the pipe-rack which is placed against the section line. If carefully cut and properly fitted, the join will not weaken the back and will not be noticed in front. Should it be deemed necessary, a thin strip of wood can be glued on the back side of the connection. The next division is between B and C ; but the article is well braced together at this junction, so that there will be little difficulty in making a successful job of it. Two pieces are cut nearly to the shape of Fig. D, one to form the bottom, which will fit *underneath* back and will be a trifle different on the *back edge ;* the other to make the top to the enclosed figure. The illustration is that of the latter, with holes in positions for bottle and glass, lines upon which brackets are placed, and enclosure for swiveling cigar stand.

To complete this latter, two scalloped circular plates are cut, the lower one having smaller holes for the *ends* of the cigars to rest in. The rack is intended to hold sixteen cigars, the diameters of which are not supposed to exceed $\frac{5}{8}$ths in. The $\frac{3}{4}$ in. centre hole is for the turned piece O to pass through, and it is upon this upright that the stand rotates, while the eight $\frac{5}{16}$ in. holes are to receive turned supports, or connecting pieces, P, which will also fit into the lower plate.

Part G (in which is included H, the front of the tobacco drawer) and parts I, I, fit *between* the semi-hexagonal pieces D D, so that the bottom board will fit *under* the *back.* It will be as well to observe this arrangement, as it causes a little alteration in the shape of the plain piece, D. When the drawer, H, is completed, it will be a good plan to line it with tin-foil, which will prevent the tobacco from getting too dry. Of course, the figure enclosed by parts H, I, I, must be also lined with some suitable coloured material, as it will not be very pleasing to see the bases of the bottle and glass through the fretworked parts. If labour is not a consideration, the right hand panel in section B can be reproduced on the left hand side by heelballing the design after it is cut, and then pasting it on the wood. The positions of the brackets, J, J, are clearly indicated, and it will be readily seen that they bind the whole thing together. Working towards the top of the design, a pretty finish is found in the V-shaped spill-holder, which should also be lined. It is narrow at the end, so as not to be in the way of pipes placed in the rack ; but as it widens towards the top, it will hold a good number of spills. A box of matches, a great consideration, can be placed in so many places upon the ornament that no particular spot has been chosen. A fancy beading can be mitred and glued on near where the bottle comes through, if it is considered a more satisfactory and complete arrangement.

To be out of the way of the articles placed in front of the "Companion," the newspapers are suspended, or attached, at the back of the ornament. Many ways of securing may suggest themselves, but the following are far from being complicated and expensive :—

Screw four little fancy knobs into the wood and stretch elastic bands (two) upon them, if they should at any time break, they can always be replaced without much trouble. Two thin leather straps with slots cut can be substituted for the bands if considered superior. The perpendicular strips of wood enclosing the oblong ornamented panel, in section B, are where the bands, or straps, are intended to be fixed ; but there is plenty of space at the disposal of the amateur.

Last in description (but not least in number, certainly) are the feet, eight of which are to be cut and fitted at the corners of the base.

If desirable to have more than one kind of drink, in consideration of one's friends' tastes, the design can easily be adapted to hold two bottles, and the glasses, to appear unpretentious, can be placed and fixed at the back of the ornament. This paragraph applies to that rarity, the generous individual. It is possible, also, by altering the form of the hexagonal piece slightly, to find a place for each tumbler, either directly in front of each bottle, or by the side of it, or in front a little to the left of one bottle and to the right of the other. Makers, however, must please themselves in this. I myself am content with a single bottle and a single glass.

SOMETHING MORE ABOUT THE WOODBURY TISSUE.

By JOSEPH HARRIS.

ON all sides there is excitement in the photographic world. In the studio of the professional, in the humble dark room of the amateur, but one question is asked, but one topic of discussion enforces attention.

Have we, as a concrete body, reverted to first principles? Have we indeed returned to the days of paper negatives, but without further operations for rendering them fit for the printer, save those to which we have become habituated in the use of glass.

The answer must be in the affirmative. From the hour when collodion was deposed and gelatine reigned in its stead, no such revolution of existing things has happened such as we now witness in the supplanting of fragile and weighty glass by the light and flexible and absolutely translucent paper; and even now it may read in the nature of a surprise that a continuous length of paper can be made perfectly transparent as glass, emulsive, and rolled up soft and pliable as a piece of silk ribbon.

Such is, nevertheless, the fact before us, and all now to be done is to welcome the *lengthy* stranger, to study peculiarities under the various processes, and to devise the best means for bringing into fullest prominence its manifest superiority over the old negative support—glass.

As to fixing, it has been found that a suspicion of methylated spirit in the proportion of about a drachm to the quart of hypo-solution, has a tendency to keep the film flatter during washing. Any want of absolute smoothness may be effectually removed by placing the negative, when *quite dry*, between the clean leaves of a copying book, and subjecting the same to the press for a night. In case a copying-press be not available, an ordinary printing frame will answer the same purpose.

It is not imperative that the Company's developer be adhered to; almost any formula of which the amateur is master will give equally beautiful results.

In handling the tissue in a wet state it should be raised from its tray by *two* corners. When in water it is a delicate material, and more than repays any care bestowed on its treatment by the brilliancy of its image, by its exquisite definition, by its perfect freedom from halation, and by the extreme softness of its light and shade.

It has been the subject of comment that its price is higher than that of the *cheapest* plates. Are *they* the standard? It is *lower* in cost than those of the best and dearest brands. Glass is not an expensive material, and is ready, without preparation, to the hand of the plate maker. The tissue has to undergo a process alike costly and critical before the emulsion stage. It is unreasonable that a portion of this expense should be placed on the charge of the paper. There may be other papers in the market cheaper than the Woodbury, and the amateur has the pleasure of rendering them transparent before they are fit for printing. In the tissue all this has been done for him.

A very important point in the manipulation of gelatine negatives is to use the hypo sufficiently strong. Nearly all the instruction books err in this particular by advising a strength of 4 oz. to the pint of water. For plates and for tissue this is not sufficiently strong. Mix it *not less than* 8 *oz. to the pint*, and leave the negative therein, either tissue or glass *not under* a quarter of an hour.

With too many practitioners, amateur and professional alike, it is the custom to rush the negative out of the hypo the instant the yellowness has disappeared. This is a negative *cleared*. Clearing a negative and *fixing* a negative are two totally distinct things. Always leave the tissue or the plate in the soda for a period of time equal to that which it took to clear. It may then be safely pronounced fixed—*but not till then*. Disregard in this particular is the cause of endless trouble with reddish brown spots in the gelatine film. While the be-puzzled operator wonders how they came there, the usual blame is attached to the maker because the manipulator declares he has done nothing to produce them. This is only another illustration of leaving *undone* those things which ought to have been done.

A PHOTOGRAPHIC ENLARGING CAMERA: ITS CONSTRUCTION AND USE.

By CHAS. A. PARKER.

III.—ENLARGING FROM FILMS—ENLARGEMENTS ON PAPER—ENLARGEMENTS ON OPAL GLASS.

FOR enlarging from "Eastman's" or "Morgan and Kidd's" films, the negative can be sandwiched between two thin glasses, and placed in the carrier the same as an ordinary plate. A thin negative will be found to enlarge the best, provided it is quite sharp and clear in the shadows. With a negative sharp and perfect, enlargements up to five or six diameters may be obtained with the greatest ease, the finished pictures possessing roundness of image, with the requisite amount of sharpness, an agreeable colour, and in fact every artistic quality that could be desired. The gelatine plate of the present time has been brought to such a high state of perfection, that by

careful focussing microscopic detail may be obtained, which will be faithfully reproduced in the enlargement. When taking a negative for after enlargement, use a small stop as a rule, to admit of a few exceptions, as it is of the first importance that the negative from which the enlargement is to be made should be as sharp as possible, in order to obtain the best results. A negative from which a perfect print can be obtained will always be found to yield a splendid enlargement.

Enlargements can now be made upon any of the contact printing paper at present in the market, which, when finished, are quite equal, if not superior, to silver prints from the original negatives. The colour of a gelatino-bromide print, which is of engraving black, although it is liked by many, is thought by some not so good as that of a print on albumenized paper ; if an enlargement is made on contact printing paper, it will be almost impossible to distinguish it from a print on albumenized paper.

It will be needless for me to give full directions, as they are sent out with all makes of paper, but a few hints with regard to its uses may not be out of place. Let the picture soak for a few minutes in clean water before the developer is applied, which should be allowed to act until all the detail is out, and no longer. As the paper will not be found to bleach in the slightest degree in the after operations, when the development is complete, the picture should be allowed to wash in several changes of water, after which it is to be placed in a strong solution of alum for two or three minutes, after which it is again washed and placed to *tone and fix* in the following solution : Saturated solution of hyposulphite of soda, *add one grain chloride of gold to each five ounces of solution.*

As a precaution, it will be found advisable to keep crystals of hyposulphite of soda in the stock bottle, for if the solution is allowed to fall below saturation point, the toning action will be found to cease, no matter how much gold is added. When the picture s toned to nearly the colour you wish, remove and wash well in several changes of clean water, then allow it to soak in alum solution for about five minutes, and then give it a final washing. These enlargements may be allowed to dry with a matt or enamel surface ; for the former allow them to dry spontaneously, squeegee them down upon a sheet of vulcanite ; when dry they will readily peel off. The vulcanite requires no preparing on account of its repellent nature ; but if they are dried upon glass it will require to be well cleaned with whiting, and then polished with powdered talc (French chalk). It will be seen that for enlarging by the processes I have described, a separate operation with the enlarging apparatus has to be gone through for each picture required. This would be excessively inconvenient, supposing a large number of pictures were required from the same negative. By adopting the following simple directions, any number of prints of any size may be produced in a very short space of time. If you should have an ordinary quarter-plate or half-plate negative, from which you wish to produce large prints upon albumenized paper, say about 15 inches by 12 inches, or larger, it will be found the best plan to make an enlarged negative upon paper, for if these very large sizes are on glass they are very likely to get broken in the printing frame, and with these large pictures the grain of the paper will not be noticed so much as it would be with the smaller sizes. After having selected the negative you desire an enlarged one to be made from, place it in an ordinary printing frame of the required size, and place an ordinary bromide dry plate upon it film to film, put the pad on the back of the plate, and close up the frame exactly as if you were printing upon ordinary albumenized paper ; but, of course, performing all these operations in the dark room, the best time being in the evening. Now take the frame out, and allow the light from a gas burner or lamp, at a distance of a couple of feet or so, to shine through the negative for a second or two, then take it back into the dark room and proceed to develope in exactly the same manner as if it was a negative taken in the camera. All the subsequent operations being precisely the same, but the resulting plate instead of being a negative will be a transparency, with all the shades correct instead of reversed. The exposure will most likely be about half that required for a positive on paper, but this can only be determined by experiment. A transparency that is under-exposed and requires to be forced in development, will not make a good enlarged negative. A good one must possess every gradation of tone to the amount of opacity required, and there should be no deposit on the film in the high lights ; and if it is placed face downwards on a sheet of white paper it should present the appearance of a brilliant but rather over-printed positive on glass that has been mounted in optical contact upon clean glass. After it is dry and varnished, any retouching that is necessary should be done, any spots or blemishes being either removed or worked up to the density of the rest of the plate by means of Indian ink, or an HB Faber's lead pencil, having previously roughened the surface of the varnish with powdered pumice-stone. When the transparency has been made as perfect as possible, place it in the carrier of the required size, and then slip it in the camera and proceed to focus as before described, but this time making the exposure upon a sheet

of contact printing paper, which is afterwards to be developed, and then you will have an enlarged negative instead of a positive as before. When it has been washed and dried it will not be transparent enough to produce good prints, therefore some method of making it transparent becomes necessary. Waxing answers very well, but requires a good deal of practice. Instead of wax, flat castor oil has been suggested, and will be found much better to use; it will take about twenty-four hours to dry, but it has the effect of making the paper transparent. It must be applied to the back of the negative, and after all the superfluous oil has been blotted off, carefully rub the coated side with a tuft of cotton wool, in order to remove any oil from the surface. Vaseline can also be used, and will be found to answer admirably; but the best medium for making paper transparent of any I have tried is "Lux," as used for the paper films. When the negative has been made transparent, it should be critically examined, and any spots or defects must be touched up with Indian ink or water colour, after which the negative will be ready for printing. The printing frames must be fitted with plate glass fronts, place the negative in the frame, and lay a sheet of sensitized paper, or contact paper upon it, print, tone, and fix, exactly the same as if it were from a glass negative. A particularly pleasing effect may be obtained by mounting prints in optical contact with glass, and it is a very attractive form of exhibiting photographs, softness and brilliancy being imparted, and details in the shadows being brought out which would otherwise be lost, supposing the ordinary method of mounting them upon cards were adopted.

Mr. T. N. Armstrong, is an authority on the various methods of producing this high class finish to pictures, therefore, I think I cannot do better than give his process *in extenso*, as it may be relied upon as being thoroughly practical. Have ready soaking in a dish of clean cold water the print or prints to be mounted, and see that they are trimmed slightly smaller than the glasses they are to be mounted upon, have also ready the glasses (patent plate is the best), and make sure they are quite clean. Now prepare a solution of gelatine as follows: Soak, say, two ounces of gelatine in clean cold water till it softens and swells, pour off the water and place the gelatine in a clean jam-pot, then pour on gently hot water (almost boiling), gently stirring till the gelatine is melted to the thickness of a thick cream; it will not take much water to do this, but be sure the water is hot. Now take a metal dish, and in it place some hot water; then take a porcelain dish, same as used for toning, fixing, etc., and see that it is small enough to fit into the metal one, and if you can get a Fletcher gas stool attached to a gas-pipe, so much the better; if not, you will require to bother the cook at her kitchen range. Now take a piece of clean muslin, and with a bit of string tie it over the top of the jam-pot just as you do covering up preserves; turn the jam-pot upside down so that the warm gelatine will run through and filter into the porcelain dish, now resting in the hot water in the metal one. This done, your gelatine is all ready.

Now take one of the glasses and submerge it in the warm gelatine, keeping it in till it is of the same temperature as the solution. Now take one of the prints from the clean cold water, and without using any blotting-paper, etc., just place it also in the warm gelatine on top of the glass, face down; allow it to remain in about thirty seconds or so, and see it is saturated with the gelatine. Now with the fingers of the left hand lift up the glass, carrying with it the print, face down, of course, and with a squeegee in the right hand press gently into contact, and sweep off with the squeegee the gelatine from the face of the glass; also place aside till set, then take a clean rag or sponge and wipe the face of the glass with hot water to remove the gelatine, but don't touch the back of the print, set aside to dry, clean the face of the glass, and the thing is done.

Now the secret of success lies in placing the glass and the prints into the warm gelatine; if these instructions be followed, there will be no slug markings but a perfectly mounted print. Prints mounted in this manner show a beautiful depth and transparency of shadow. They can be framed in oak frames, the glass taking the place of the glass of the frame. A second glass should on no account be placed in front of the one supporting the print. Positive enlargements upon opal glass have a most charming effect, and very beautiful pictures can also be obtained by direct positive printing in an ordinary printing frame; the purity of the white matt surface of the glass is like alabaster.

The instructions sent out with the plates should be implicitly followed; a few hints, therefore, with regard to their use will be all I shall give. It is of first importance that they should not be exposed to any but a "safe light," or the purity of the whites will be impaired. They may be toned to any colour desired exactly the same as silver prints. If they are to be viewed as transparencies hung up in a window, they must be more fully developed than in any other case. For direct printing, thin delicate, but fully exposed, negatives will be found to give the best results, place the film side of the negative in contact with the coated side of the opal plate in an ordinary printing frame, which should be placed several feet from a batswing burner, or similar light, the exposure will

vary according to the sensitiveness of the plates and the density of the negative employed. Strict cleanliness must be exercised with regard to all dishes, etc., used. All the solutions should be freshly mixed, and the plates should be always varnished as this increases the brilliancy of the picture.

It may be added that an enlargement of a photograph upon an opal requires only a suitable frame to make it a presentable and pleasing picture. I believe that they are the most permanent pictures ever produced by any process in which silver is the sensitive agent; certainly they are the most beautiful. When it is possible the enlargement should be vignetted, the picture being kept small in proportion to the size of the plate, as the pearly white appearance of the opalotype is considered to be its greatest charm. All the operations for enlarging upon opals are exactly the same as I have previously described for argentic paper, the focussing being previously performed by placing a piece of ground glass between the grooved boards A and B of the enlarging easel (see Figs. 7 and 13), which is to be replaced by an opal plate.

(*To be continued.*)

NOTES ON NOVELTIES.

By THE EDITOR.

1. THE BRITANNIA COMPANY'S GEAR CUTTER FOR LATHE. 2. THE BRITANNIA COMPANY'S IMPROVED EMERY WHEELS AND STEEL CUTTERS FOR LATHE WORK. 3. MELHUISH'S NEW PATENT JOINER'S CRAMP. 4. MEDLAND'S NEW PORTABLE CABINET FOR MICROSCOPIC OBJECTS. 5. ZILLES' AMATEUR'S MATERIALS FOR FRETWORK, CARVING, ETC. 6. MESSRS. HARGER BROTHERS' DESIGNS AND SPECIALITIES. 7. MENZIES' "PRACTICAL DIRECTIONS FOR SOFTENING WATER," ETC. 8. THE WOODBURY TISSUE AND VERGARA'S DARK SLIDE. 9. "THE STORY OF THE INVENTION OF STEEL PENS."

1. THE BRITANNIA COMPANY'S GEAR CUTTER FOR LATHE.—An excellent illustration of this desirable novelty which has been recently produced by the Britannia Company, *Colchester*, is given in Fig. 1 on the opposite page, which is so clearly drawn and so beautifully engraved, that all that it is necessary to know in order to understand the principle and utility of the machine may be gathered from a careful inspection and examination of it. It can be fitted upon the slide-rest of any lathe, and the cross and parallel slides are thus utilised to give the necessary traverse. It may also be fixed upon an ordinary tool post. It is driven from an overhead pulley. The milling cutters are held on the spindle by the nut and washer, and a vertical slide gives the necessary vertical traverse. If anyone does not immediately recognize the purposes for which the machine may be used, and inquires what kind of work may be executed with its aid, it may be said that it is a most useful adjunct to the lathe for fluting taps, milling key ways, executing spiral fluting, and for cutting bevel and worm wheels. Wheels with any number of teeth may be accurately cut by means of a division plate. Appliances for turning out work of this nature have hitherto been very costly, but the cost of the Britannia Company's New Gear Cutter for the Lathe, adapted for lathes up to 6 inch centres, is £4 4s. Thus it is brought within the reach of many amateurs who, by its assistance, will be able to accomplish many pieces of work of different kinds which hitherto have been quite beyond their reach.

2. *The Britannia Company's Improved Emery Wheels and Steel Cutters for Lathe Work.*—These Emery Wheels are illustrated in Fig. 2 (A, B, C), and the Steel Cutters in Fig. 3. The former are for use on the lathe for grinding by means of emery or corundum wheels, or for polishing, by removing the emery wheels and substituting for them buff wheels or polishing brushes. They can be held in the tool holder or applied to the work by any other suitable means. It may be added that the use of emery wheels for surfacing metals is very economical. It is now some time since engineers began to use them for this purpose, but many amateurs are following the engineers' lead in adopting them, and with these appliances within their reach, many more will doubtless be led to do so. The Steel Cutters, one of which is shown in Fig. 3, are for use on the milling apparatus of lathe, and are made in many forms and sizes in order to meet the requirements of the turner in executing different kinds of work. The Britannia Company have omitted to furnish me with the prices of the wheels and cutters, but a post-card to the Company will speedily elicit the desired information for anyone who wishes to take advantage of them.

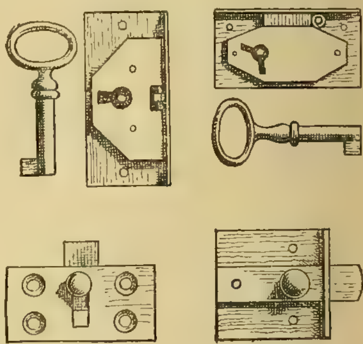


FIG. 10.—LOCKS, ETC., FOR FRETWORK CABINETS.

3. *Melhuish's New Patent Joiner's Cramp.*—This is a new and useful invention which has been recently patented and produced by Mr. Richard Melhuish, the head of the firm of Melhuish and Sons, 83 *and* 85, *Fetter Lane, Holborn, W.C.*, and which he is now in a position to supply to order at 10s. each. Now all woodworkers are well aware that a joiner's cramp is a very cumbersome and weighty appliance, especially when of any considerable size and length, and when a joiner has to carry one with him to his work, he never regrets his arrival at his journey's end. With this new cramp, however, he has nothing more to carry with him but the portion marked A, in Fig. 4, which consists of an iron carrier far more rigid and solid than the fixed jaw of the old-fashioned cramp, and which is pierced for a bar cut

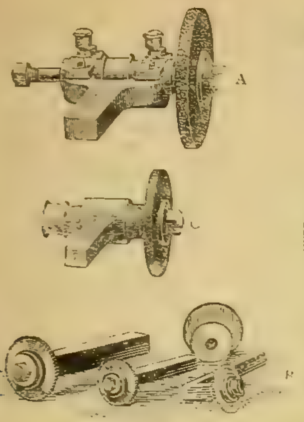


FIG. 2 (A, B, C).—IMPROVED EMERY-WHEELS FOR LATHE WORK.

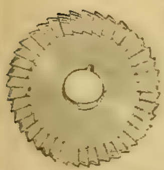


FIG. 3.—STEEL CUTTER FOR MILLING IN LATHE.

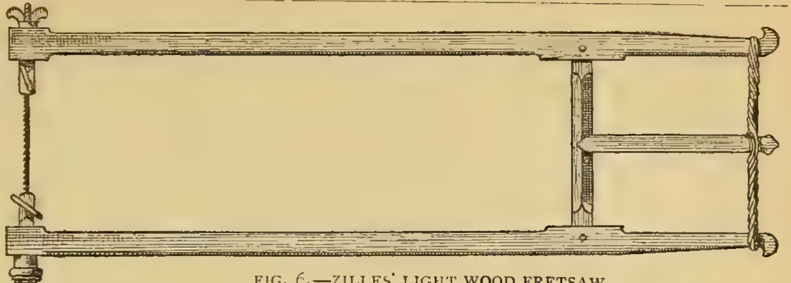


FIG. 6.—ZILLES' LIGHT WOOD FRETSAW.

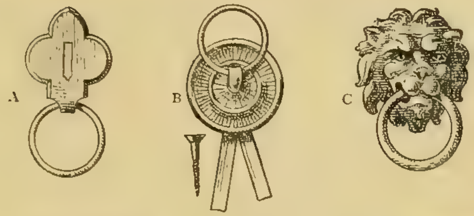


FIG. 7 (A, B, C).—FITTINGS FOR FRETWORK CABINETS, ETC.

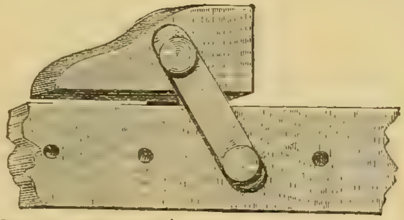


FIG. 4.—MELHUISH'S NEW PATENT JOINER'S CRAMP.

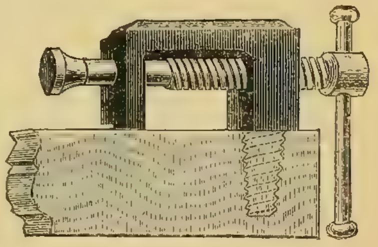


FIG. 8.—ZILLES' WOOD VICE.

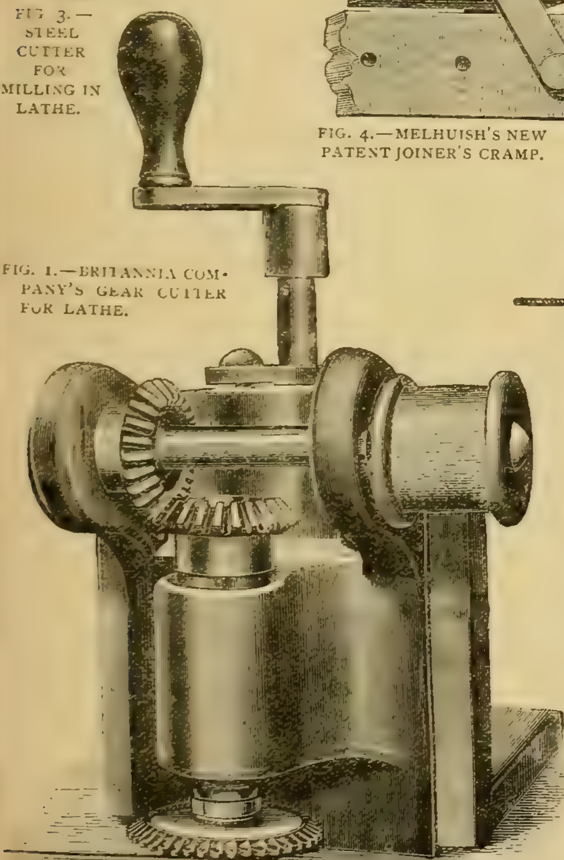
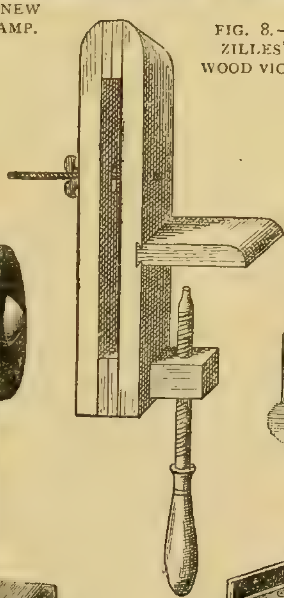


FIG. 1.—BRITANNIA COMPANY'S GEAR CUTTER FOR LATHE.



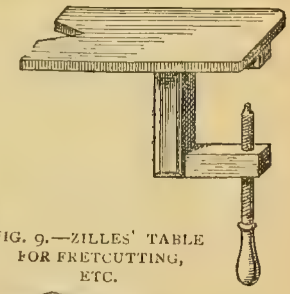


FIG. 9.—ZILLES' TABLE FOR FRETCUTTING, ETC.

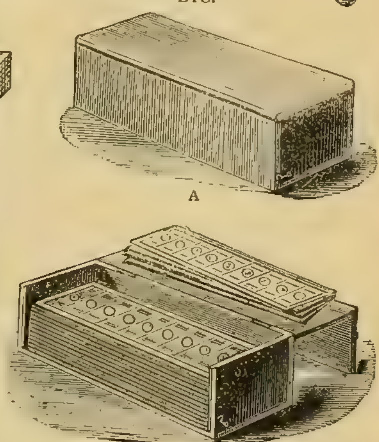


FIG. 5.—MEDLAND'S NEW PORTABLE CABINET FOR MICROSCOPIC OBJECTS—A, CLOSED; B, OPEN.

with a screw, and furnished with a necessary handle for turning it forwards to exert pressure, or backwards when the pressure is relaxed, and a second vertical fixed bar, also cut with a screw, and proceeding from the bottom of the thick part of the carrier. To use this appliance, this vertical bar is inserted into a piece of wood which does duty for the bar of the cramp, while the movable jaw against which the work to be cramped is butted is formed of another block of wood, which is attached to the bar by a couple of plates and bolts, as shown in the illustration. As the part A is the only portion that the workman has to carry with him he can convey it to the place of operation in his basket with his tools without inconvenience, and the rest can be easily and quickly improvised of pieces of rough timber that may be near at hand.

4. *Medland's New Portable Cabinet for Microscopic Objects.*—Readers of AMATEUR WORK who are fond of microscopic examinations of objects will be interested in the New Portable Cabinet for Microscopic Objects that has been recently produced by Mr. J. B. Medland, Optician, 12, *Borough, London Bridge, S.E.* The cabinet is illustrated in Fig. 5, in which it is shown closed at A, and open at B. At first sight the box or cabinet itself presents rather a puzzling aspect, as it shows hinges on both sides of the cover, and hooks to secure the whole on the ends close to the bottom; but when the hooks are drawn back it is found that the front comes away from the body of the box as well as the lid, and that when the lid is thrown back to the fullest extent, the front turning downwards on the hinges by which it is attached to the lid forms a support to the latter, converting it into a stand for the reception of the trays as they are removed in succession from the box. The cabinet is made of polished pine, and contains sixteen trays of cardboard, each holding nine slides or objects so that the whole contains a hundred and forty-four slides. The trays are furnished at each side with a flap, which turns over the slides, and thus keeps them in place. The flaps of each successive tray are held down by the tray above it, the lid when closed holding the whole firmly down. The cabinet, outside measurement, is 10⅝ inches long, 4⅝ inches wide, and 3¼ inches high. Thus when closed, although of the same height and width as the ordinary case, which only holds seventy-two slides, it is not more than 2½ inches longer. The adaptation of the lid for holding the trays when the box is open enables the microscopist to keep them together, and preserve them from getting displaced or upset, which they are likely to do when placed among other apparatus or upon the desk or work table. The advantages of size, compactness, and improvements over the ordinary case by which it is marked, will render the cabinet desirable to demonstrators of practical physiology and histology, medical students, and all microscopists, who may require to carry a number of objects in a small space with the least possible risk of damage.

5. *Zilles' Amateur's Materials for Fretwork, Carving, etc.*—Mr. Zilles sends me his New List of Materials and Designs, which cancels List No. 25, the new List being No. 29. In this his latest list many of the older numbers have been cancelled, and better designs substituted for those which formerly occupied their place. New ones have also been added, from No. 644 to 648 inclusive, and also from No. 745 to 768. These include many useful and beautiful designs which, unfortunately, I have not space to mention in detail, but as the list may be obtained on application to Mr. Henry Zilles, 9, *South Street, Finsbury, E.C.*, those who send for it will have the advantage of a full and complete list, which will be far better than the mere enumeration here of what I may consider the cream of the designs. Mr. Zilles has added to his stock many useful articles and beautiful art work, and among the latter I may specify some fretwork designs in brown and colours, on white holly wood. These litho designs can only be had on the wood, and cost from 2d. to 24s. each, according to size and mode of production, including the requisite accessories. Among the new appliances for fretcutting and fretwork that Mr. Zilles has now on sale, I may call attention to his Light Wooden Fretsaw Frame and Brace, illustrated in Fig. 6, which on account of its lightness is easily handled, and from the length of its arms is able to compass work of considerable size. These are sold, 12 inches deep, at 3s.; 16 inches at 3s. 6d.; and 20 inches at 4s. Fig. 7 shows some fittings for fretwork, which are much required and sought after by amateur fretworkers, the prices ranging low, namely, A, 4d. each; B, 3d. each; and C, 2d. each. With B is shown a small and very fine screw ¼ inch long, supplied at 15s. 6d. per gross. In Fig. 8, a Wood Vice, similar in most respects to that noticed in Vol. V., page 476, but it is smaller and cheaper, being supplied at 3s. each, the Improved Cutting Board, illustrated in Fig. 9, being sold at 1s. 3d. Lastly in Fig. 10, some very nice brass locks, snaps, and catches for drawers and doors of cabinets are illustrated. These, if I mistake not, cost no more than from 3d. to 8d. each, and apparently are the smallest articles of the kind at present in the market.

6. *Messrs. Harger Brothers' Designs and Specialities.*—Messrs. Harger Brothers, *Settle, Yorkshire*, send me some of their latest designs for fretwork, and some miniatures exhibiting the elevations of some very elaborate and tasteful pieces of furniture in fretwork, anyone of which would employ a fretsawyer for a considerable time to execute, but would well repay him for the labour expended on it when finished. Of these I may specially recommend No. 591, Elegant Corner Cabinet with Receptacles and Mirrors, 5 feet 11 inches high, 2 feet wide, and 1 foot deep, 4s.; No. 592, a Canterbury Whatnot, height 3 feet 1 inch, breadth 1 foot 10 inches, and width 1 foot 2½ inches, 2s.; No. 595, a Drawing-Room Cabinet with Mirror, height 5 feet, breadth 2 feet 3 inches, depth 1 foot, 4s.; No. 600, a Slipper Box, 9d.; and No. 602, a Coal Vase, 2s. The designs for these articles are printed in brown, as are the designs, for many other well conceived and carefully-drawn patterns for glove boxes, brackets, work boxes, photo frames, finger plates for doors, etc., to none of which I can take exception, while the last-named, I can certainly recommend for adoption instead of finger plates of china and metal. Messrs. Harger Brothers have also added to their large stock some designs for carving. They consist chiefly of photo frames, wall brackets, and hand mirrors. All are well executed, and form

good models for carvers to copy. I am inclined to select the Wall Bracket, No. 580, and Cabinet Photo Frame, No. 585, as the best and most striking of the whole, but the latter would have looked better if the broad parts of the design had been on the left and *bottom* of frame instead of on the left and *top*, to prevent any appearance of top heaviness. The chief novelty and speciality, however, among Messrs. Harger Brothers' recent productions is to be found in their New Medallions, for insertion in fretwork or any other kind of woodwork or metalwork. The Medallions are executed very nicely in Wedgewood ware, and exhibit white figures in bas relief on a blue ground varying from light to dark; they are round, oval, and octagonal in shape, and cost up to 1½ inch, 1s. each; 2 inches, 1s. 6d.; 3 inches, 2s.; 4 inches, 3s. 3d.; 5 inches, 4s. From a specimen medallion now before me I can recommend them. The subjects are chiefly figures.

7. *Menzies' "Practical Directions for Softening Water," etc.*—This is a little book which contains a great deal of most useful information. Its full title, which forms an excellent synopsis of its contents, is "Practical Directions for Softening Water, Making Soap, Wool Washing and Bleaching, specially intended for Managers and Superintendents of Woollen and Worsted Factories, Dyers, and Bleachers, Wool Washing Establishments, and Large Steam Laundries," by W. J. Menzies. It is published by McCorquodale and Co., Limited, *Newton-le-Willows*, *Lancashire*, and *London*, at 6d. I regret I have not space to go through the thirty-four pages of the work seriatim. I can only repeat that it gives simple but ample practical directions for Softening Water, Making Soap, and Bleaching Cotton and Linen Goods. I specially recommend it to the notice of colonial as well as home readers, as well as two other works by the same author, published by the same firm at the same price, namely, "New Methods of Wool Washing, Fleece Scouring, Sheep Dipping and Cleansing," specially intended for the use of sheep farmers, squatters, and colonial wool scourers, and "The Laundry Guide," which has already been mentioned in these pages.

8. *The Woodbury Tissue and Vergara's Dark Slide.*—These useful and most desirable additions to the appliances of the photographer have already been brought under the notice of the readers of AMATEUR WORK, by Mr. Joseph Harris, an esteemed contributor to these pages. For my part I am not a photographer, and therefore I am in no way competent to pronounce on the merits of the Tissue, nor do I venture to handle the specimens sent me, being very sure that if I did I should be no wiser than I was before. For the description then of the Tissue itself, and of the mode adopted in its manufacture, I can only refer my readers to Mr. Harris's papers in Vol. V., pages 467 and 557, and Vol. VI., page 37. Of the Dark Slide, otherwise Vergara's Patent Slide, I am better able to speak, as it will bear examination better than the Tissue. The specimen before me measures 8 inches by 6 inches, and will take tissue 6½ inches by 4¾ inches. I presume, therefore, I may take it as being size No. 3 in the Price List given below. The thickness of the slide is slightly over ½ inch. It is made of Spanish mahogany, beautifully polished, but a cheaper kind in cardboard is supplied in all sizes. In the external frame are three slides, two of which move upwards, and one—the central one—downwards in grooves made for their reception and retention in place. Each slide will take a double piece of tissue, one fold on each side of the central division, which moves downwards as it has been said. The external slides are beautifully made. Each is in two parts, the upper part, which is clamped on each side, being 5⅝ inches long, and the lower part 2 inches. The two parts are connected by a backing of some textile fabric, so that the two parts are, as it were, hinged together. The slides when closed are held in place by brass stops. The advantages claimed for the slide are that the paper is readily inserted, and as readily removed; that the weight of one slide with two papers is about one-half to one-third the weight and *cost* of the ordinary dark slide with two glasses; that it can be easily fitted to existing cameras; that the register of the focussing glass is the same as with the old slides; and that tables are affixed to the shutters for recording necessary details of exposure, etc., for subsequent reference. It is filled for two exposures by the insertion of a shutter (which I have termed the central slide), and has no loose parts and no hinges. No carriers are required, as pieces of paper of smaller size than the slide can be inserted for exposure. The various sizes and prices of the Tissue, dark slides, and Vergara's Negative Album for the preservation and insertion of negatives produced on the Woodbury Tissue are as follows:—

Sizes.	Negative Tissue.				Patent Slides.				Albums.	
	Per Box of 2 Doz.		Per Roll of 1 Doz.		Cardboard.		Sp. Mahogany.			
in. in.	*s*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
4¼ by 3¼	3	6	2	0	3	0	9	6	4	6
5 ,, 4	5	6	3	0	3	6	10	3	5	0
6½ ,, 4¾	8	0	4	6	4	6	12	0	6	0
7½ ,, 4½	9	0	5	0	5	6	13	9	8	0
7½ ,, 5	10	0	5	6	6	0	14	6	8	0
8 ,, 5	11	0	6	0	6	6	15	3	10	6
8½ ,, 6½	15	0	8	0	8	0	17	6	10	6
10 ,, 8	20	0	——		9	6	20	0	19	0
12 ,, 10	30	0	——		12	6	25	0	24	0

The address of the Woodbury Tissue Company, it may be useful to state, is *Java House*, *Manor Road*, *Norwood Junction*, *London*, *S.E.*, although letters addressed to the Manager, simply *Java House*, *South Norwood*, *S.E.*, will not fail to reach their destination.

9. "*The Story of the Invention of Steel Pens.*"—All who use steel pens, and there must be but few who write who still adhere to the old quill, may pass a profitab'e hour in gathering the story of their invention, and a knowledge of the manufacturing processes by which they are produced, from an interesting illustrated pamphlet, bearing this title, written by Mr. Henry Bore, and published by Perry and Co., Limited, *Holborn Viaduct*, *London*, *E.C.*, and Messrs. Cornish Brothers, *New Street*, *Birmingham*. Few, I think, know the origin of the metallic pen, and how and by whom it has been brought to its present state of perfection. All this is well told in Mr. Bore's valuable record.

AMATEURS IN COUNCIL.

I. INSTRUCTIONS TO CONTRIBUTORS AND CORRESPONDENTS.

1. Contributors to AMATEUR WORK, and Correspondents asking or answering Questions in "Amateurs in Council," are requested to write on one side only of the paper.

2. When Illustrations or Diagrams are necessary, draw them on a separate piece of paper, and do not insert them in, or mix them up with, the Manuscript that they are intended to explain, or in which they are described. This is necessary, because the Illustrations go to the Engraver and the Manuscript to the Printer, and it is not fair to the EDITOR to put him to the trouble of separating them.

3. In writing to the EDITOR, whose address is simply, "EDITOR OF AMATEUR WORK, *Warwick House, Salisbury Square, London, E.C.*," there is no necessity to adopt the conventional epistolary form in asking or answering queries. Put the question you wish to ask, or the reply you wish to make, as briefly as possible, and write every separate question and every separate reply on separate pieces of paper. Sign each with initials, nom-de-plume, or name and address, as preferred.

4. When replying to questions put forth under the heading INFORMATION SOUGHT, let the reply be headed, REPLY TO INFORMATION SOUGHT BY ———, PAGE —, and then give the heading of the query as it appears in AMATEUR WORK.

5. It must be fully understood that Letters or Communications and Manuscripts in which these Rules are not rigidly observed may possibly be put aside and passed over without attention.

6. The EDITOR reserves to himself the right of refusing a reply to any question that may be frivolous, or inappropriate, or devoid of general interest. Replies to queries cannot be sent by post. Correspondents must bear in mind that their queries can be answered only in the pages of the Magazine, the information sought being supplied for the benefit of its readers generally, as well as for those who have a special interest in obtaining it.

II. AMATEUR WORK, SALE, PURCHASE, AND EXCHANGE NOTICES.

1. All Notices of Articles for Sale, Purchase, or Exchange sent to the EDITOR appear in the Red Advertising Pages of this Magazine. They must be prepaid, and accompanied with Penny Postage Stamps, as follows: For Twelve Words, or less than Twelve Words, 3d.; and for every additional Four Words, or less than Four Words, 1d.

2. Every Single Article (unless the Articles advertised are of the same kind or nature: as Books, Tools, Organ Materials, etc.) must form the Subject of a Separate Advertisement.

3. No Trade Advertisements can be inserted in this Department, which is open to *bona fide* Amateurs only. The EDITOR reserves the right of refusing to insert any Notice, in which case Stamps sent will be duly returned.

4. Persons who reply to any Notice, must write direct to Advertiser, and place the application in an envelope sealed down, with a PENNY STAMP attached in the upper right hand corner, and the NUMBER of the Notice in the lower left hand corner, in the position shown in the annexed form:

5. Letters thus sealed, stamped, and numbered, must be enclosed to the EDITOR, who will write the necessary addresses on them and forward them through the Post to the persons for whom they are intended.

6. It is necessary that the above Rules should be strictly observed. Notices sent without Stamps will be returned to the senders, and, with regard to replies to Notices, no attention will be paid to any in which the forms prescribed above are not complied with.

7. It is desirable that those who reply to Notices in this Department should enclose to Advertiser, with their application, a stamped and directed envelope, in order to ensure an answer. When this precaution is not taken, the non-receipt of a reply within reasonable time can only intimate that the article in question is disposed of, or that the proposal made is declined.

Irregular Striking in Clock.

T. B. (*Pickering*).—You say that you "have an American clock that often strikes once too few, and when it does so, it strikes one five minutes before striking the next hour." There are two very general things

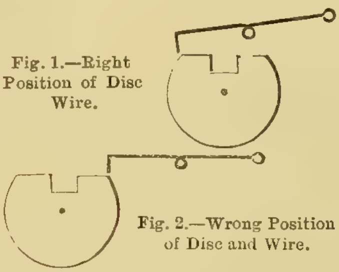


Fig. 1.—Right Position of Disc Wire.

Fig. 2.—Wrong Position of Disc and Wire.

IRREGULAR STRIKING IN CLOCK.

that cause this; the simplest is that the hammer tail or part that is lifted by the pins in the wheel, is often bent in a little and rubs against the side or band of the wheel, and the teeth catch against it and lift it up, and so causing it to strike. The other is that the striking train of wheels is put together slovenly and not in the proper position to each other. To remedy in either case, first take off hands and face, unhang pendulum bob, open the slit in which the pendulum rod is held, and gently remove the rod, unhang the weights, and take movement out of case. Now see if the short pin of hammer is rubbing side of wheel; if so, bend it out a little till quite free of the wheel; if it is already free you must look for the other fault. Put a finger on the wheel that has the pins in the band standing at right angles to the wheel, and gently push it round, stopping the fly so that you may see the working. Now when the hammer tail falls from the pin, stop the fly, and look at the wheel next to the one with the pins in it, and you will see a disc of brass with a flat and notch in it, as in Fig. 1, and a piece of wire with one end bent to a hook, and that ought to be in the position of the sketch; if it is not, and I think you will find that is not there, but as shown in Fig. 2, consequently, when the hook drops in the notch, the hammer has not dropped off quite, but when it warns for the next hour it strikes one and finishes the hour at the proper time. To correct it, take out the two pins of the top pillars that hold the frame together, open the frame sufficient to take the wheel with the disc on it out of the back plate bearing, and holding the pin wheel steady, turn the wheel with the disc on it (called the loop or plate wheel) backwards one tooth of the pinion; replace it in its place, and see the fly and other wheels back all right should any have come out. Now try the striking, and see that the hammer falls when the hook is in the position of Fig. 1. If not successful repeat the dose till correct, and now perhaps you will find the warning wrong. To try it, put the minute hand on, and turn gently and slowly round till about ten or five minutes to the hour, at the same time pushing the pin wheel and see that when the hook is freed from the notch, that the fly gives about half a turn before catching on the arm that comes up to stop it; if it does not move half a turn open the plates as before, and shift the pinion one or two teeth, and try again, till it has a full half turn or rather more. The arrangement in the different company's striking varies a little; but I think you will be able to see the working from the foregoing. If not, write again.—A. B. C.

Sheet Cork.

CORKEY.—Presuming that you require "sheet cork," as you term it, ⅛ inch thick, for lining boxes, drawers, or trays, for the preservation of butterflies, moths, etc., it is probable that you may be able to get what you want on application to any naturalist or bird-stuffer in the town or neighbourhood in which you live. If you reside in a town of some size or importance you will most likely, by the aid of the local directory, find the name and address of a cork-cutter who will furnish you with some. Lastly, failing these, buy some cork such as is usually supplied to fishermen for their nets or for bath cork, and saw it yourself, or get it sawn for you by a carpenter into slices. Cork is not sold by the square foot, but by the pound, the price being from 3d. per lb. upwards, according to quality. It may be obtained from the London and Lisbon Cork Wood Company, Limited, 28, *Upper Thames Street, London, E.C.*, who will forward you a price list on application.

Glass Discs and Emery for Speculum Grinding.

C. W. N. (*Southgate*) writes:—"In expressing my appreciation of Mr. Francis' papers on "The Reflecting Telescope," and the valuable insight into practical optics that is afforded by them, let me say that in my own case I have found some difficulty in procuring materials; my two 6½ inch

glass discs were not ground accurately to the patterns sent, the edges also were somewhat chipped. I have had to grind fully $\frac{1}{8}$ inch off part of the edge in my $3\frac{1}{2}$ inch lathe before the disc for my speculum was true. The tool, I infer, will not matter if a little out of a true circle. The emeries I have had to get at Buck's on the *Viaduct*, as I found the local oilmen sold rubbish under that name. For the rouge I expect to have to go to Clerkenwell. Mr. Francis, will probably say that he mentioned Messrs. Oakey, but they are wholesale people, and I have failed to get good emery from those who profess to retail their goods." To this Mr. Francis replies: "The glass or metal tool should be made as nearly circular as possible: it is safest to do this. Possibly you obtained the commonest emery which contains about 90 per cent. of dirt, and which is useful only for cleaning bright metal surfaces. If the tradesmen will not obtain the more expensive kind, resort should be had to a first-class toolmaker, lapidary, or dealer in watchmakers' or jewellers' sundries, at either of which places a good, although expensive, emery may be obtained. Of course it is cheapest in the end; there is little waste in washing. The rouge may be obtained in like manner; it will cost 5s. or 6s. a pound. The purple tinge requisite should be watched for. Any amateur who meets with a difficulty in the practice of this somewhat difficult hobby, is invited to appeal to me at once for advice through the Editor."

Toothache Battery.

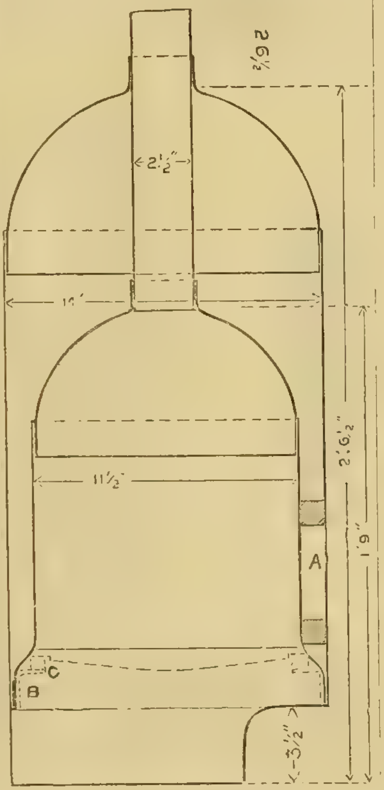
J. L. D. (*New Quay*).—An inquiry for a "Toothache Battery" has a tendency to provoke broad smiles, but I can fully sympathise with you, because I have passed through a period of martyrdom similar to that of which you complain, and have now only a few teeth left. I have tried a large variety of so-called curative medicines and processes, including shocks from a battery, but none of these nostrums were efficacious as cures, although most of them were for the time remedial in giving temporary ease from pain. Toothache is a symptom of a more serious disease, and we must attack the disease to relieve pain in the teeth. The most potent cause of toothache is indigestion, and this is caused by such a large number of sins in eating, drinking, and living, as to demand that the patient should consult confidentially a competent medical practitioner and abide by his advice. Shocks from an electric machine, medical coil, or battery, may for a time give temporary relief from pain when other symptoms indicate neuralgia, but such shocks will not *cure* the disease. You may, if you like, write to Dr. Allinson, office of *Weekly Times and Echo*, detailing all your habits, symptoms, etc., and seek his advice.—G. E.

Drawing of Lever Escapement.

A PRACTICAL WATCHMAKER.—You are quite right as regards the number of teeth in the pallets, and I must express my regret for not having given enough in my sketch. I have not a "Seth Thomas" by me at present, so I forget how many they take in; but a "Welch" I have here takes in four, and an "Ansonia" three; but when I made the rough sketch I really never thought of the number of teeth, but merely desired to give a slight idea. However, I am glad to be "picked up," and will be more careful for the future. Of course, you can see the pallets are really not at the correct angles, as well as being short of teeth, but I am a very poor hand at drawing.—A. B. C.

Vertical Boiler with Dome Top.

INDISSOLVABLE.—The above will give a fair idea of the size boiler you require. Make it of sheet copper, $\frac{1}{16}$ or $\frac{3}{32}$ of an inch thick. Safety valve to be one inch in



SECTIONAL SKETCH OF VERTICAL BOILER WITH DOME TOP.

diameter, and loaded to 20 lbs. per square inch. The fire-bars are shown in dotted lines. All the joints are to be riveted and soldered. The shell is to be made first, and the fire-box, with the chimney fitted in, afterwards.—OLIA PODRIDA.

Printing Negatives.

J. G. (*Ballyhaunis*).—Printing and all other branches of the art will be fully treated upon in due course.—C. C. V.

Finishing Wood Carving.

TAURUS.—In answer to your inquiry, I would advise for carvings in walnut the following treatment: Firstly give them a coat of linseed oil, and let them dry for two or three days, then brush them well with as stiff a brush as the delicacy of the work will admit. During this operation a piece of cold beeswax should be rubbed on the brush now and again. This will give the walnut wood carvings a soft dry shine. The above treatment, however, will not answer for limewood. The great Grinling Gibbons carved mostly in lime, and in no case did he varnish or polish his work, but left it fresh from the tool. Lime, however, being a light coloured soft wood, soon gets soiled, and some people object to it on that account. Personally I prefer the dirt to the cleanliness of varnish. But if TAURUS desires to varnish, the following methods should be used: First a coat of thin size, and allow dry, then another coat of the same, and again give time to dry. Any roughness on the carving caused by the size being put on too thickly, should be rubbed down with very *worn out* No. 0 glasspaper. Next get some white hard varnish and thin it down considerably with spirits of wine, and give the carving two coats, allowing the first coat to dry thoroughly before applying the second. After which the prominent parts of the carvings can be further smoothed with a rubber of light polish, which should look like milk. The glossy sticky appearance of most varnished carved work is caused by using varnishes too thick in substance. Two or three thin coats being infinitely better than one thick one.—GEORGE ALFRED ROGERS, The Wood Carving Studio, 29, *Maddox Street, W.*

Painting Dog-Cart.

W. L. (*Golborne*).—If I were you I would have the dog-cart painted all black, then you can line it with any colour. You will have to scrape off the paint and varnish from the body. To do this get a pint of liquid ammonia, pour it in a tin or basin, and rub it on the panels; in a few minutes the coating will scrape or peel off. Get a plane iron and scrape *downwards*. Whilst you are scraping one side have the ammonia on the other. This applies to the outside of body only; the inside, leather work, wheels, shafts, and ironwork, must not be scraped. Give the body a good washing down, then rub all the panels with pumice-stone. Have a painter's table near you (Fig. 1), having on it a piece of flag stone to rub the pumice-stone smooth upon; then rub the panels until they are smooth. Keep rubbing the pumice-stone on the flag, as if not smooth it will scratch the panel. Now put the wheel upon the horse (Fig. 1) and sandpaper the wheel, and the shafts also. If the paint upon the ironwork of the spring, etc., is chipped, showing the iron, you must file all the paint off to get to the iron. Wash the body well down and dust the wheels and shafts; mix some lead colour composed of best tub lead, black ground in turps, and boiled oil, and a little of gold size. Do not put much oil in or the paint will never dry. The paint when on should be very dull; if shiny, it is too oily and will crack, as only the top dries, and underneath the surface it is wet. Paint the body outside, the springs, shafts, and wheels; but if the dash and splash boards are leather they must not be touched. In painting the panels finish off each panel before going on

with the next. Stroke the paint well down, and, above all, do not put much on. In painting the wheels get your table with paint on at your side: stand behind the wheel, paint one-half of the spoke nearest to you, and then turn the wheel round, and go on from one spoke to another until you have painted all of them; then go to the other side and finish painting the reverse side, then paint the back. When one-half of the spokes are painted all round, turn the wheel and horse to the front of you, and finish painting the other side of spokes. Now paint the nave, then paint the inside of felloes between the spokes, then paint the back of felloes, and lastly, the front of felloes. This is the proper way to paint or varnish a wheel. Next turn the shafts wrong side up, paint the underneath, or as you have it now at the top, then paint the other side. Let this lead colour dry for twenty-four hours, or even two days, but be sure it dries dull. You should test it before painting your trap; if there are any dints or small cracks to be filled, mix the following stopping: Get some dry white lead, about a tablespoonful, and a dessertspoonful of gold size, mix with the white lead into a paste; if too thick add some turps. Get a knife and plaster to stop these cracks or dints up. In a few hours the stopping will be quite dry. Sandpaper where you have put the stopping, then sandpaper the body. If the wheels require any stopping, mix the following preparation: whiting, boiled oil, and japan. Stop up any places required, or to give a level surface to the wood where it is uneven. Sandpaper the wheels and shafts well. Get half a pound of black ground in turpentine and some gold size; put it in a clean pot and stir well up; if too thick, add turps. Do not put too much gold size with the black or it will dry shiny, and probably would ciss. This gold size is mixed with the black or with any other colour to hasten the process of drying and hardening, and the quantity used must be in proportion to the time in which the paint is required to dry. To test the dead black when mixed to see if sufficient gold

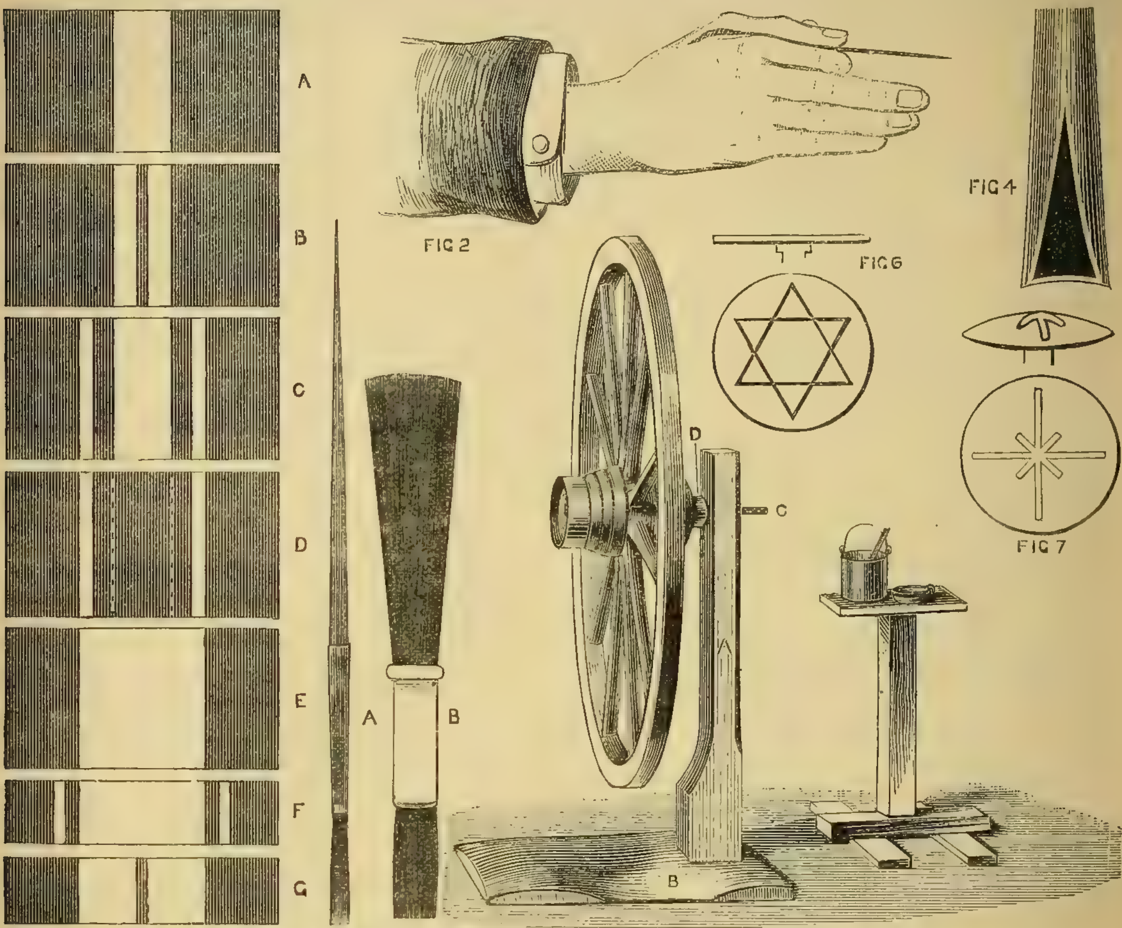


FIG 5 FIG 3 FIG 1

PAINTING DOG CART.

Fig. 1.—Sketch of Wheel Horse and Painter's Table (Dimensions of Wheel Horse: A, Upright, 3 ft. 4 in. high, 3 in. thick at top, 4½ in. thick at foot; B, Base, 2 ft. long, 1 ft. broad, 2 in. thick near upright; C, Iron Rod, 14 in. long, 1 in. thick; D, Bobbin, 2 in. thick. If Naves have bolts through they will catch uprights unless there is a Bobbin. Fig. 2.—Right Position of Hand, showing how to hold Fine Liner. Fig. 3.—Liners: A, Fine Liner, with piece of wood to make it longer; B, Broad Liner. Fig. 4.—Lining on face of Spoke. Fig. 5.—Linings on Spokes: A, Centre line blue, green, yellow, or vermilion, on black or dark ground; B, Centre line, with fine line in middle of the same colour as spoke, making broad line look like two fine lines, and line to be put on the wheels, etc., first, when dry the fine line is put on; C, Centre line, with two fine lines at each side (this lining is the most difficult of all); D, Two fine lines: if on a coloured spoke the space between should have a broad line of black, as shown by dotted lines; E, Broad line: if on a wheel painted vermilion it should be black. On black it should be tan colour, or a very light brown, as these are the only two colours which can be lined so broad as they will not appear showy. This broad line can also have a fine line at each side as at F, or in the centre of broad line, as at G. Fig. 6.—Lining on Cheese-headed Bolts. Fig. 7.—Lining on Common Bolt Head.

size is in, put some on your thumb nail; in five minutes, when dry, brush your hand across the nail; if the black is not rubbed off it is then right for using. Give the body, wheels, shafts, and springs a coat of this black. In painting the panels be sure to "lay the paint off," as the painters say, or in other words, brush it down. This paint on the body will be quite dry by the time you have finished the wheels and shafts. Get some good japan, the best you can buy, and give the body and wheels, etc., a coat of it, then leave it a day to dry. Next day you can either flat it down and line it, or give it another coat of japan after flatting it down. Japan is, as you perhaps know, used upon black painted grounds, and is a sort of black varnish; it improves the depth and lustre of the colour. Coach-painters nearly always use it except when they want to turn a job out quickly. Give two coats of this japan upon a coat of dead black, thereby ensuring a beautiful finish. Supposing you have given the dog-cart a coat of japan, next day take some pumice-stone powder in a dish or small fig-box, pour some water upon it, then make a pad of cloth, and scour or flat the panels. Flat one panel at a time; be particular in washing off the powder with a sponge, and wiping afterwards with chamois leather. Get all the panels washed off. Afterwards flat the wheels, and in fact everything which has had the japan on. Be careful in flatting the sharp edges of any part of the trap or you will rub all the paint away, thus exposing the wood. When all is flatted down and washed, the dog-cart will look like ebony. Now give the dog-cart another coat of japan, and in a day or two flat down again with pumice-stone powder; be particular to wash the powder off and wipe with leather. If the powder dries on, it is not so easy to get it off; besides the varnish showing it. Now commence lining; the lining colour is bought in powder. You will not require much, so I would suggest that you purchase it at an artist's material shop, so that you get it genuine, because some of the colours are adulterated, such as chrome yellow, blue vermilion, and a few other colours, so that if we buy them from an artist's shop we are sure to get them pure. Put your colour on a slate or marble slab, or stone, pour some gold size in the powder colour, and mix with a knife into a thin paste, crush the lumps well out with the knife, and if you have a muller grind it. Put the paste thus made in a pot and add turps to thin it a little. Then get another pot for dippers, and in this put some turps and gold size to dip the fine liner or pencil in. Next get a piece of glass to serve as pallet. A very nice colour for lining is a broad centre line of very light blue. This is lined on the centre of each spoke to round the felloes: the same again with vermilion or primrose yellow, or straw colour. These last two are mixed as follows: Yellow chrome and dry white lead; less white makes it primrose, and more white straw colour. If you have a broad centre line—say a quarter of an inch across—you can fine line again on this line with black, and when finished it will have the appearance of having two fine lines close together, or we can line a centre line and two fine lines each side of centre line, as in your sketch; but I think this would show your imperfections more than any other way of lining. Your sketch, as shown at c, Fig. 5, is the lining mostly painted: the centre line is put on first on all the spokes and the felloes, then the fine lines after. I think if you put two fine lines only, leaving the centre line out—and this is often done—it would suit you better. In lining hold your pencil or fine liner in your right hand, let the quill end rest on the first finger and your thumb on the top; the other three fingers serve as a guide, stand at the back of the wheel with your chest against the hoop. Dip the fine liner in colour, put the colour on the palette, which you hold in the left hand, and line the wheel, beginning almost from the nave. When nearing the felloes you will find that you cannot get any farther leave off here; go on all round like this; be sure you keep the three fingers to guide you at the back or front of spokes as required. When one side of spokes are lined, you must join the lines. Begin from the felloes, and run the line in with the other, line the other side of spokes in the same way; then line the back and front of felloes. In lining the felloes you had better let the nave rest on the block, as you will never line the felloes on a wheel horse. First line the back then line the front. When the front is up, line the face of spokes (see Fig. 4) for lining. If you prefer it, you can line the body on the standards only at the outside: this is easier than lining the wheels, as you only line on the edge of woodwork, so that if you are careful it is impossible to line crooked. Fine line the shafts and springs; the shafts must only be lined up to the tug stopper, or about one foot six inches off the end; but I would advise you to see a dog-cart and notice whereabouts it is lined, so that you will have a correct idea of what you ought to do. Now go over the wheels and body with damp leather, as sometimes the lining has had too much gold size in it, and when varnished it will ciss. In varnishing be sure to use a clean basin and brush free from grit or grease. You will require one or two different varnishes for the body. The best durable finishing body varnish is very pale, brilliant, and exceedingly durable. Best elastic carriage varnish is somewhat like the body varnish, but is darker in colour, and dries harder and quicker than body varnish: coach-painters varnish the body and wheels with this varnish. In varnishing the body stroke the varnish well down, and do not use it sparingly, or it will be duller in some places than in others. If it runs in some places stroke the brush well out on the basin and stroke the panel. *Caution.*—Never add turps to the varnish, or let your varnish brush get near turps whilst varnishing. Now varnish the wheels in the same way as I told you how to paint them, and then varnish the shafts and springs. I think I omitted to tell you, when lining the wheels, to fine line the nave, but do so; and always have a clean rag beside you on lining to rub out mistakes: this rag should be dipped in turps and oil. In a day or two, or the longer the better, put your wheels and shafts on the trap. If the leather work has not been touched give them a coat of japan.—W. P.

Modification of Slide-Rest for Planing and Shaping.

*** The illustration of this "Modification" sent by A. F. C. (*Bombay*) has been accidentally turned upside down. Readers are requested to note this, and reverse the page when examining the cut.—ED.

H. H. D. B.—You will see from the above that attention has been called to the error in position of cut of "Modification of Slide-Rest for Planing and Shaping." I cannot afford space to engrave your tracing of "Balck's Girder Lathe Planer," taken from the "English Mechanic;" nor, indeed, would it be fair to the "English Mechanic," and the writer of the papers upon it, namely, the Rev. James Lukin, considering the importance of the invention and the planer itself as a piece of mechanism. Possibly Mr. Lukin may give a description of it in these pages if nothing stands in the way of his doing so.

Woodbury Tissue.

THE MANAGER OF THE WOODBURY TISSUE COMPANY would be other than human did he not most highly appreciate the too generous praise of A SUBSCRIBER FROM COMMENCEMENT, whose admiration of the new tissue is endorsed by very flattering testimonials received from all parts of the country. The Manager will be delighted to give to every amateur who may so desire, all the advice and assistance in his power, not alone respecting the special manufacture in which he is engaged, but on positive printing or any other branch of the art. Thirty years' experience are at the free disposal of those who are pleased to seek it. It speaks volumes for the editorial conduct and management of AMATEUR WORK, that amidst all competitors it was the *first* to announce the introduction of the most important event in photography since the day when gelatine superseded collodion. [I am sincerely obliged to the Manager of the Woodbury Tissue Company for his kind expression towards myself, but I must remind him that after all I am only in the position of the policeman who acts on "information received." Had I not been put on the right track, I should assuredly have been nowhere as regards the Tissue. Let me state for the information of all who are interested in the matter that letters, etc., respecting the Tissue and Vergara's Dark Slide, should be addressed "THE MANAGER, Woodbury Tissue Company, *Java House, South Norwood, London, S.E.*—ED.]

Concrete.

H. P.—"Concrete: Its Use in Building," an excellent and exhaustive work on this subject, is published by Messrs. E. and F. N. Spon, 48, *Charing Cross, W.C.*; and F. W. Reynolds and Co., 73, *Southwark Street, S.E.*

Violin Making by Amateurs.

A. W. H. (*King's Lynn*) writes:—"I have just finished a violin from Mr. Allen's instructions, and have succeeded beyond my most sanguine expectations. Messrs. Hill and Sons supplied me with the necessary materials, the maple for the back being splendidly marked. I also obtained from them a very good and quick-drying varnish. From the illustrations given in Part 16, I made a purfling gauge from three pieces of beech, and gauging callipers from a piece of deal and part of an old thermometer scale, the cost being *nothing*. For violin screws I took a hint from one of your correspondents, and got the blacksmith to put a thread on some ½ inch iron, and used an old broom handle for nuts. By using Le Page's Carriage Glue I had no difficulty in putting on the back or belly; it does not set so quickly as common glue, which gives time for manipulating one's work. I diluted the glue before fixing the belly. I have had one advantage over most amateur violin makers in having had the privilege of hearing, seeing, and handling a genuine Straduarius. The possessor of the instrument which belonged to Ernst, the violinist, was paying a visit in this village in the early part of this summer, and he not only allowed me to carefully examine the instrument, but he very kindly marked on the rough neck I had procured from Messrs. Hill, the length and width of the neck of the genuine violin, and also traced the outline on a sheet of paper, and marked the position of the *f* holes. On comparing these with the outline in the Supplement of Part 17, I found them to correspond *so exactly* that I should say both instruments were made *from the same mould*. This should help to silence such persons as Mr. Taylor and others of your correspondents, who doubted if Straduarius ever made so *small* a violin. The date was 1721.

Wooden Bee-Hives.

T. R. (*Pickering*).—You will find full instructions on this subject in the forthcoming papers on Bee Hives and Bee Furniture, by Mr. Walter J. Stanford.

INFORMATION SUPPLIED.

Paper for Mounting Photographs.

C. A. P. writes in reply to ONLY AN AMATEUR:—"You require what is known as rock, or velvet paper, used for making photographic mounts, covering old ones, lining exhibition cases, etc. It can be obtained from Messrs. J. F. Shew & Co., 88, *Newman Street, London, W.*, at the following prices:—

	s. d.
12½ inches wide, per yard ...	0 10
22½ " " ...	1 0
27½ " " ...	1 8
31½ " " ...	2 3

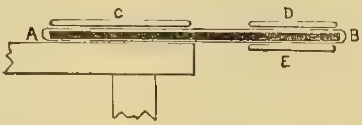
Or, in a roll of 9 yards:—

19½ inches wide	6 9
22½ "	8 0
27½ "	13 0
31½ "	17 6

It can be had in four colours, viz., black, maroon, grey, and green.

Cutting Large Looking-Glass.

C. A. P. writes, in answer to E W.:—"This requires some care, but, above all, don't be afraid that you will spoil it, or you will be certain to fail. First sharpen a graver so as to get a very fine point, then obtain a pennyworth of camphorated oil of turps, dip the tool in this, place the looking-glass on some soft or level surface, so as to prevent the possibility of damaging the quicksilver, and then with a carpenter's rule accurately measure the centre of the glass, and make a mark at the top and bottom with the graver, get the rule exactly in position and *boldly* draw a straight line with the graver from the mark at the top to the one at the bottom. The most difficult part of the operation is to successfully break it in half. The accompanying diagram may help to make this clear. Wrap a piece of cloth entirely round the glass, and place one half of it, A, on a table, so that the other portion, B, overlaps, then lay a flat piece of wood, C, upon A, and get a friend to place both his hands on this, so as to hold it down firm. The other half, B, sandwich between two strips of wood of sufficient length, D and E. Then hold this firmly at each extremity whilst your friend is keeping the other half in position. Now bear down on it *suddenly* and *evenly*, when



CUTTING LARGE LOOKING GLASS.

it will be found to break off clean and sharp. By using the two boards, D and E, it will ensure the break being even, otherwise it might branch off and thus spoil it. Practise first upon some piece of glass (plate) that you require to be broken."

Cutting Glass Bottles.

J. S. B. writes in reply to J. B. C. (Vol. V., p. 336).—"The following recipe is from a French source, but the quantities are given in Apothecaries' Weight, English: Scratch with a file or diamond round the bottle. Take of lampblack 6 ounces, of gum arabic 2 ounces, and of gum benzoin ½ ounce: mix and make into a pencil: light and apply to the scratch."

Steel.

H. A. M. writes in reply to G. M. H. (*Blackheath*):—"The best house in the trade is Smith's, of *St. John's Square, St. John's Street Road, E.C.*, of whom steel in all sizes, also rolled, cast, or sheet brass and wire can be obtained in any size, at wholesale prices for the smallest quantities."

Lacquered Brass Screws.

H. A. M. writes in reply to R. A. W. (*Dublin*):—"You should write to Messrs. Davis and Timmins, *Charles Street, Hatton Garden, E.C.*, who make every class of terminals and screws at very low prices, their work being of excellent quality and best finish."

Steel for Small Drills and Taps.

A. M. R. writes in reply to STADT DRESDEN (Vol. V., page 480):—"Round steel wire, extra quality, for drills, etc., can be obtained from Messrs. Townley and Sons, *Bull Street, Birmingham*. I have found this very good, indeed, and very even in temper."

INFORMATION SOUGHT.

Vehicle moved by Spring.

JACK writes:—"I am anxious to get a light wooden vehicle built, say about 56 lbs. weight, to carry two persons 12 stone each. Would anyone kindly inform me could such a vehicle be driven by the action of a spring, worked on the same principle as that of a watch or clock.

Covered Strings for Violin.

A. W. H. (*King's Lynn*) writes:—"Can you give me the address of Mr. Hart, from whom Mr. Allen procures his *covered strings?*" [I am afraid it would be time lost to send your query to Mr. Allen. Let me suggest that a letter to Mr. Hills, of *Wardour Street*, would obtain the information you require. —ED.]

Cheap Filter.

ROSEWATER asks:—Can any of the readers of AMATEUR WORK kindly tell me how to make a cheap filter?

Black Ink for Rubber Stamps.

Professor L. MARISSIAUX wishes for a thoroughly good and reliable recipe for black ink for rubber stamps—an aniline and glycerine ink.

Case for Violin

A. W. H. (*King's Lynn*) writes:—"Having finished a violin, I now want to make a case for it. Can any reader of "ours" give me working drawings for such a one as Fig. 56, in Vol. I., page 398, with advice as to the best kind of wood to use?"

Bore of Flute.

J. G. B. (*Nelson, N.Z.*) asks:—How is the bore of a flute tube made conical? Are any special tools required? I should like to see some articles on Flute Making in AMATEUR WORK.

Laryngoscope.

J. G. B. (*Nelson, N.Z.*) writes:—"Directions wanted for making a simple but effective Laryngoscope."

Beale's Choreutoscope.

J. G. B. (*Nelson, N.Z.*) asks:—Will any reader kindly inform me how to make Beale's Choreutoscope? Full directions required.

Barrel of Bird Organ.

H. S. asks:—Can any correspondent inform me how the needles or wires are put on the barrel of a bird organ? I mean how am I to know where to place them for the proper notes? Is it done by rolling the piece of music on the barrel, and placing the wires or pins on the several notes, and then taking the paper away, or how?

Paint-Grinding Mill.

NIL DESPER. asks:—Can any reader give me an idea, with or without drawings, of the different parts of a paint-grinding mill, for making and putting together myself.

LETTERS RECEIVED UP TO OCT. 13.

[*Replies to these in Next Part.*]

E. P. (*Midleton, Co. Cork*); H. D. G.; J. S. B.; LINNÆUS; S. P. L.; RACAVAR; T. K. (*Wood Green*); C. B. B. H. (*Ballyhaunis*); H. G.; J. M. (*Sunderland*); GROOVED BARREL; W. L. (*Golborne*); F. A. M.; A NEW SUBSCRIBER; T. B. (*Chard*); BENHAM & FROUD; W. C. C. and MUSICUS; D. B. A.; TINMAN; H. B. I. (*Worcester*); R. K. (*Chelsea*); SEMPER PARATUS.

MAGIC-LANTERN SLIDES:

HOW TO MAKE THEM AND PAINT THEM.

By Rev. O. BECKERLEGGE.

II.—STUDY IN LANDSCAPE—DISTANCE—MIDDLE DISTANCE, FOREGROUND — OUTLINING — BAKING — SECOND STAGE—SKY—HILLS—WATER—STUDY IN TREES.

HAVING got so far, we may proceed with a more ambitious piece of work, viz., landscape. Figs. 5 and 6 are little compositions I have designed which will afford good practice, and not be very difficult, but which, with care, will yield good results. Fig. 5 will be the easier, so we will begin with it. Place your glass on the picture as at first directed, with a piece of tracing-paper under it, and begin to trace in the lines. For this purpose you must either take a fine pointed brush (rigger) or a crow-quill pen—some prefer the latter; if you prefer the pen, or find you can produce better results with it, by all means use it; it must be filled with a brush, and not by dipping it in the paint. Begin at the top left-hand corner, and with a clear steady line—as thin and faint as possible,

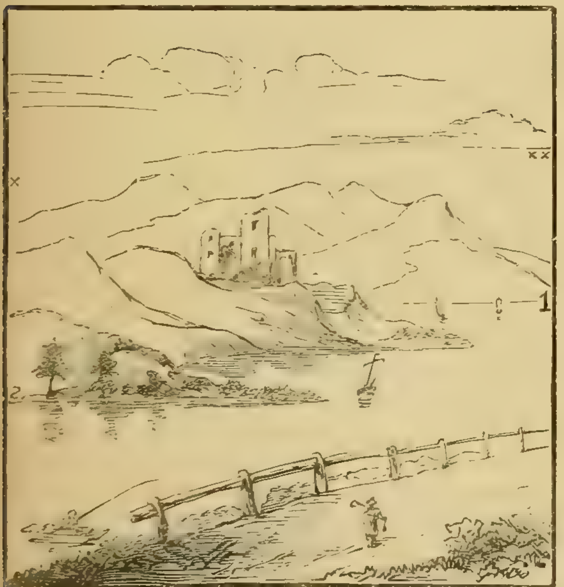


FIG. 5.—EASY EXAMPLE IN LANDSCAPE.

yet continuous—draw the outline of the most distant hills.

In this picture you will see distinctly what must be in every landscape, viz., distance, middle distance, and foreground. Each of these must have a different treatment to produce good perspective and atmospheric effects. Distance finishes at the foot of the hill marked 1; but even in distance we must remember that there are points more remote from the eye than others, and, consequently, are more hazy because of a greater depth of atmosphere for the eye to penetrate. There is a hill peeping up between two others: by making that less distinct than the others, greater depth and realistic effect will be given to the composition.

At 2, the middle distance terminates. Here will

FIG. 6.—LANDSCAPE, WITH STUDY OF TREES.

be seen various degrees of distance between the point where it joins the water and the hill on which stands a ruin. The same principle holds good in this case as in the other. Greater distinctness and detail must appear in those points nearest the eye. The outline, therefore, of this group of hills must be somewhat more distinct than the other. Of course, in nature there is no distinct line marking the boundary of objects, and if we were working in ordinary water or oil colour work, no outline would be shown, but the work we are now upon requires it.

We next have the foreground. This must be decidedly more distinct; yet, at the same time, it must be remembered, the lines must be perfectly true and without raggedness, as whatever roughness there is will be magnified on the screen. I need hardly say that no shading in this process is allowed; nothing but the outline of the various objects. All this work must be done with the magnifying glass constantly in the hand. When the outlining is completed, place the slide in a warm oven—NOT HOT—leaving it there say over night. In this, as in all subsequent operations, we must make time play an important part, and make haste slowly. On taking our work out of the

oven, we must go over it most carefully with the eye-glass and examine every line. If any appear rough or too heavy, then with our knife we must remove the same, and bring them into as perfect a state as possible. If any line has had to be removed entirely, then it must be again drawn and baked; unless this is done, the lines will work up on the after painting. With a soft brush, or bird's wing, remove every particle of dust from the glass, as a very minute particle would form a nucleus around which the paint, at each subsequent stage, will gather—no matter in how minute quantities—and on the screen would be projected as a huge blot.

We are now ready for the second stage. For this purpose we place it on the easel, with a sheet of the whitest paper under the easel to act as a reflector. Do not forget this, as without it we shall not see the tints we are working with. Now a good deal depends on our light. A window with a north aspect is best for all artistic work in paint. It will appear plain that to all those living in the latitude of England a north aspect is the least subject to variations of light and shade. In the east or west the shadow will be reversed as the day goes on, and in a south aspect we may be exposed to sunlight, so that all things considered, the north light, though not so intense, is less changeable, and this is most desirable. Another point is, we must, if possible, avoid a room with a cross light. A room with any aspect is better than one with cross lights. We must place our easel so that our light shall be at our left, and fall as direct as possible on the reflecting surface placed under the work.

Let us commence at the sky. Draw an imaginary line from * to **; you will see this in an oblique direction. Looking at nature you will discover that the light in the sky is never parallel with the horizon; we accordingly must follow her teachings: nearer the sun, greater the amount of light. We may either have a ruddy or a golden sky. Take pure orange, or gamboge and crimson lake, mixing it with medium No. 2. With a full brush take your colour across from * to **, rather below than above. Very carefully work the colour around the outlines of hills, touching them in every place, but not going beyond. Your paint must be thin enough to work smoothly, but not to POOL. It must be of such a consistency that it will readily go where it is desired, and stop where it is placed. Pass the brush between your finger and thumb, so as to flatten it, and with a series of gentle strokes, get an even tint, deepest at the bottom, gradually thinner towards the top.

And now begins our real difficulty, and one, let me say, which can be only overcome by practice. Of course, if you could get to *see* it done it would be much better. We must "dab" the sky so as to get a perfectly even tone—such as cannot be obtained by a brush. Many kinds of dabbers are used, but my advice is to use your finger—either the third or fourth—wiping it clean on the palm of the other hand. Should your finger tip be hard and rough, then use the finger of a white kid glove; but I will suppose the finger is fairly smooth and soft. Pass the tip of the finger over the wet paint with a quick, soft, gentle dab—by this means, you will be able to take off any redundant paint and graduate the tint; if any spot seems weak, then dab the finger on the palette, taking up a little colour and so dab it on the sky. This may seem rather difficult, but with a little care and patience it will be acquired, and you will gain an even *tone* in your sky. Now take blue, mixing it with a little medium, and begin at the top of the picture. Paint downwards, making the colour weaker as you near the horizon; come very close to the haze just put in, but not to touch it. This must be treated as the other—with a flattened brush, stroke and coax it now in one direction, and again in another, until you have a fairly graduated sky.

And here let me make a remark or two once for all. In the first place it will be understood, unless otherwise expressed, that all paint is mixed with medium No. 2; secondly, before beginning to work on a part as critical as a sky, all colour should be tried first on a spare bit of glass; and, thirdly, on either wiping the finger when used as a dabber or in cleaning brushes, *never use cotton rags*, they are always fluffy, use linen or an old silk handkerchief; but in cleaning the finger for a dabber, nothing is equal to the soft part of the other hand.

Having done our best with the brush, we must now proceed with dabbing—weakening strong parts by taking off, and strengthening weak places by first dabbing the finger on the palette and taking up a little colour.

Now comes the tug—by a gentle rolling kind of dab blend the two colours together. Of course, each colour has been growing paler as they have been approaching. When the work is done there will be a space neither blue nor orange, but a blending of one shade into another—that is as it should be. When the work is finished it may be that as you look at it minutely you may see the finger marks giving a kind of grain to the work, that is of no consequence. You must remember that whilst everything will be magnified, so also when enlarged it will be seen at a corresponding distance—so that the effect on an audience will be the same as it would be to a person looking at the slide at an ordinary distance.

If your work, when looked at with a white paper under, as when on the easel, present a pure even

tone, so will it look when magnified and thrown on a screen before an audience. In this, as in most other matters, a certain "distance lends enchantment to the scene."

We will now take a purplish tint, and work on very faintly the distant hill that peeps from between two others. Let those that stand next in distance be treated a little more firmly, giving the points nearest the light a rosier or golden cast, and with a grey, a shade darker than the body of the mountains, put in the shadows farthest from the light. As you come down to the foot where it joins the lake, give it a greenish cast. Now work the old castle that stands in the middle distance. The gable and the central tower paint with a rosy tint, putting in very delicate shadows with sienna, as well as those parts which fall back. Touching windows with umber. Now mix a green of blue and sienna, and put in the hills on which the castle stands, putting in the broken shadows with sienna. For the projecting hill, No. 2, prepare gamboge and blue to a tender green; let the shading in this be more distinct than the last, as that was more distinct than the most distant hills; with the darker green put in the trees and low bushes.

But I find I am so engrossed in mentally painting my picture that I am forgetting time, and that in this kind of work is an element which cannot be overlooked. I am afraid my pupil will be in danger of misunderstanding me. We must not attempt to over-paint or lay one colour on another either to strengthen or give shadow until the first has been hardened in an oven, but more of this as we pass on. I am now simply desirous of preventing a mistake, and, as I think I said before, and I cannot too strongly emphasize it—that before we should attempt to paint, the general teaching of my lessons should be fairly mastered.

The water will now engage our attention. That part which lies between the distant hill and the first headland must partake of the orange of the sky, and here let me say to my young artist that water has no colour—it simply reflects the colour of the objects around. From the headland we must paint the water blue, of a gradual depth of tone, deepest next the eye. We now come to the foreground, and here we can put in some detail. For the road—lake, sienna, and yellow; when you have got a desirable tint, paint it on evenly, leaving the fence for the present. Our picture should now stand till it hardens. The best way to do this will be to put it, standing on its edge, in a warm oven all night; by the next day it will be hard. We must now put in the shadows and strengthen any part that seems weak; put in the fence with vandyke brown, letting the tint grow weaker in the distance. Mark in the roughness of the road with umber; put in the grass by the margin of the road, the boats, and the figure in the road.

I do not see how I can make these matters plainer; to see it done would be worth a hundred verbal lessons. But I think I have made the art as clear as it is possible by verbal descriptions. After the second painting, again bake—not burn. If any part seem hard and opaque, touch it with varnish —this will restore its transparency. You will now find bits on the foreground and in the distant shadows that require a little more depth; do this now, and again bake. Now put it in the lantern and see the effects. That there will be defects you may be sure, in your first effort—parts that are dull touch with varnish; where there is not depth enough, touch with a deeper tint. Naturalness will be given to the water by drawing lines across with blue of a deeper tint. Let the distant edge of the stroke be somewhat well defined, but the nearer edge should melt away. Distance will be given by the graduated boats—for the most distant one, with the point of your knife, scratch out the sail, and under the boat make another scratch for the reflection of sail; the middle boat scratch out the sail and paint it in with sienna, marking the masts with black.

In Fig. 6 I have given another subject, which contains a study in trees. Let the sky, hills, water, and road, be treated in the same manner as the last. My instructions here refer to the trees only. Trunk—sienna, strongly marked in the second painting with vandyke brown. Branches—the topmost, which catch the sun, red. It is the property of fir trees to look red in sun light. Let the marking of the trunks be less distinct, as they recede from the eye. Foliage—make a tender green and pass it over the foliage; when hard, with a deeper green, indigo and gamboge, put in shadows. For the third painting add a little crimson lake, and with it put in the under shadows so as to give depth. I purpose working the views—which are purely imaginary—out in water-colour, so that if anyone would like to borrow, for the sake of having the whole thing before their eye whilst working, I shall be glad to help them.

I will now say, by way of conclusion, that if anyone will faithfully follow the lessons given, he will, with practice, be enabled to produce pictures worth looking at; and will doubtless be able to make them of commercial value. As a parting injunction—wash all brushes as soon as one colour is done with in turps, so that no trace of colour is left in them, for should there be, it will be sure to work up in the next colour, and spoil the picture.

In a future article I propose to give instructions for producing various mechanical effects, which always lend a wonderful charm to a picture.

REPOUSSÉ, OR RAISED METAL WORK.

By H. C. STANDAGE,
Author of the "Artist's Manual of Pigments," etc., etc.

I. — REPOUSSÉ WORK DEFINED — CELLINI'S CLASP — BEATING OF THE METAL—TRAVELLING OF PARTICLES OF METAL—STUDY FOR BEGINNERS—CARADOSSO'S WORK.

ALL visitors to the Healtheries in 1885, and who passed through "Old London," could not fail to see an artificer at work stamping out of a sheet of metal some figures in relief by means of various punches and a small hammer. It was fascinating to watch this person in his clever manipulations of the metal and his tools. To see a sheet of metal perfectly flat, eventually represent in alto relievo, the figure of a horse's head, a portrait, a group of figures, yet, nevertheless, the sheet of metal retains its original linear dimensions. All who watched this man would ponder over it how it was that he raised some portions of the metal sheet and sunk others without in any way diminishing the metal too much, not enough, or without piercing it with holes; therein is concealed the art of repoussé* work. The work is not executed by merely hitting certain sized and shaped punches with a small hammer; the shape and size of the punch is merely a means to an end. The art of repoussé consists in knowing how to deal with the metal at work, and so that it shall produce the design desired. Hitting the punches in a certain way will cause the metal to become stouter in thickness, while certain other kinds of blows will make the metal thinner; and the art of the worker consists in knowing what kind of blow and where required to cause the sheet of metal to be bulged up or thinned in any particular part. This knowledge, to be of practical use, is only to be obtained by experience with different metals because the ductility, cohesive power of the particles and other peculiar characteristics of the various metals, vary with each.

FIG. I.—RIDGE SURROUNDING CONCAVITY.

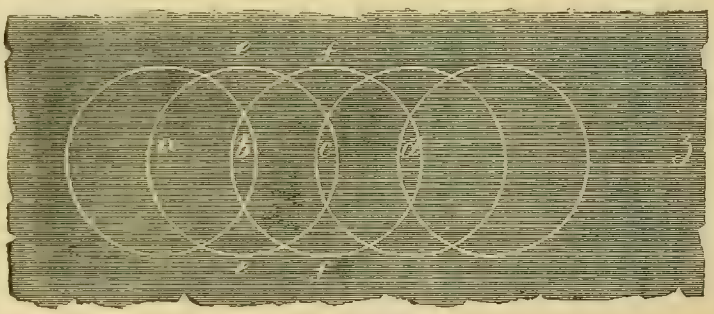


FIG. 2.—DIAGRAM EXPLAINING MODE OF TRANSFERRING METAL.

The object of these papers, therefore, is to set before our readers what I know of the subject, hoping that they, by experience gained herefrom, may be able to produce work creditable to themselves. To tell how, where, and with what force every blow of the hammer is to be made when evolving a design from the flat sheet, is impossible on paper; personal illustration accompanied by verbal explanations might readily do so, but to endeavour to put these details on paper would be an insuperable task, because half a dozen different blows, all different in force and direction, might have to be given on one particular spot in the metal plate.

I, therefore, purpose to give the directions and methods of raising designs in sheet metal as pursued by some of the old dead artists of several centuries ago, the original producers of those works in metal that were and are the admiration of antecedent and the present generation. Those early workers took pride in their work; objects in metal were not required in such abundance as to induce the establishment of foundries. The work of a man's hand was valued for its intrinsic worth, the value of the time, labour, skill, and thought bestowed on the production of the object. Only the wealthy needed these objects, and only they it was who could patronise the producers of such objects. The artificer, therefore, did not slavishly copy nor follow some previous worker, but set to work to carry out his own ideas. The results we have in it are splendid examples of metal work, to be seen in our museums.

The mere description of how these early workers manipulated their materials will not alone suffice to produce a skilled worker in raised metal work; he must know something of the nature and qualities of the material he is working on. It will, therefore, be to our purpose to give this information as regards those metals the amateur is likely to employ in his early efforts

* This word is undoubtedly from the French verb "Repousser," to repel, repulse, recoil.

—copper, iron, silver, and even gold. Illustrations of the best specimens of the work of the old artists in metal, and of the tools needed, and the methods of using them, will be given, so that the reader shall be set fairly in the way of commencing the art, his enthusiasm enabling him to become proficient in it.

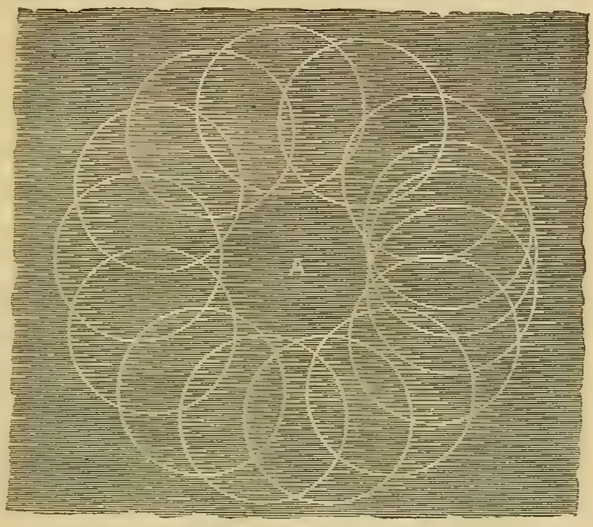


FIG. 3.—THICKENING OF METAL IN CENTRAL PART.

The following description of making and ornamenting a gold clasp by the great Florentine worker in metal and other arts — Cellini — is taken from his celebrated treatise on goldsmith's work. "Being also fit for our purpose I will here speek of a gold clasp of a rounded form, which I made for Pope Clement the Seventh, with which he fastened his mantle, and partly of the manner in which I worked it. This clasp was of the character of a palm (three inches), and from its large size very difficult to work, for in small works the material is more obedient to the hand. My labour in this was so much the greater, inasmuch as I was tied to certain jewels which would be set in the compartments of it. Amongst them was a diamond what had been bought at the price of 36,000 scudi (about £7,600). Upon this most noble gem I adjusted a figure of 'Our Heavenly Father,' seated and giving with befitting dignity the benediction; the head and arms of which I had made quite round, the remainder being allotted to the field. Around this figure I arranged more than one troop of angels; of these some wound themselves round the borders of the robe, and some I arranged with skill amongst the other jewels."

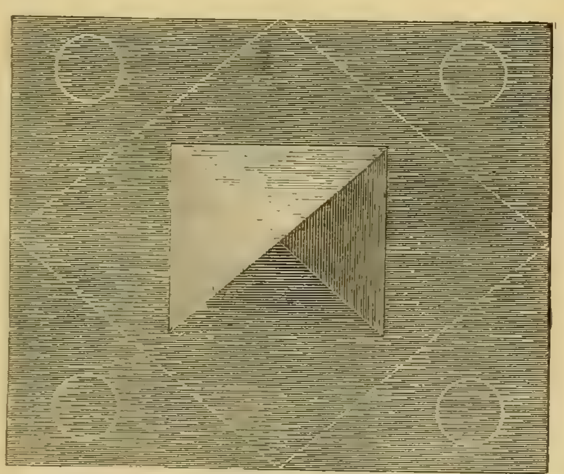


FIG. 4.—STUDY OF PYRAMID, ETC., IN COPPER.

Although this writer refers to himself as working skilfully, he is not in the least bit conceited, as apparently from his words he would seem to be, for in other parts of his excellent treatise he most indignantly protests against conceit in any one. Truly, he must have been skilful to arrange and make out the number of figures in the small space (three inches across) of metal at disposal. "I had to employ," he continues, "part of those cherubs I made in whole relief, some in middle, and others in low relief, according as I wished them to appear near or distant, following in this the rules of design and perspective. Having made the model the exact size of the intended work, I took a sheet of gold, larger by a finger all round than it would be when finished, and commenced bulging it in the middle, striking it with small hammers on the face of an anvil, but on the inside. I struck it with the point of the hammer, thus causing it to swell up very much in the middle, and where I observed that it was too thick I worked with the punches on either side, till the principal figure—that of the Father—began to assume a suitable form. In this way, little by little, using all sorts of punches, with patience and enthusiasm, I made the gold plate obedient to me, and in a few days I very nearly got the figure of the 'Father' quite round." By being "quite round" is meant in full relief. In this description of beating up a figure in relief there are several points to be especially noticed.

In the first place, the beating of the metal as the sheet lay on the face of the anvil would thin that part of the sheet where the hammer fell; but as there is no loss of metal, the particles driven away by the blows of the hammer, must find a resting place somewhere; they are in reality forced out from under the face of the hammer towards its edge; *e.g.*, strike a sheet of copper with a round-faced hammer, a concave depression will be produced where the centre of

the hammer struck the copper, but at the edges of this concavity the metal will form a ridge slightly higher than the adjacent level surfaces. Some of the metallic particles have travelled away from beneath the surface of the hammer, and where the force of the impact ceased, their progress was arrested, and they remain raised above the metal that had not felt the blow of the hammer (see Fig. 1).

This travelling of the metallic particles is due to the ductility of the metal, which quality varies with the metal, or its mode of preparation. The ductility of the steel surface of an anvil is very small; its particles repel the blow of the hammer, and send away that instrument with a ringing sound. A piece of copper does not so repel the hammer, but the malleability of the metal permits it to endure the blow without repulsion, while the ductility of the metal allows the particles to spread themselves over the parts not struck. Now it is conceivable, and what is more, perfectly realisable, to force a proportion of metal from one part of the sheet to any desired part by a series of blows properly applied. For example, suppose we wish to send a portion of metal from A to Z, in Fig. 2. It can be done thus (using a convex surfaced hammer): Strike a blow with the hammer so that it falls on the point A, then the second blow of the hammer should be made so that the centre of curvature of the hammer's face falls at B, within the circumference of the depression made by the first blow. This will cause the metallic particles that form a ridge round the surface of A to be carried still further to the right. The third blow should be struck in a similar manner so that the initial point of contact of the blow falls within the periphery of the depression caused by the second blow, and so on with the subsequent blows. For the benefit of those readers who do not see the reason of this a few words of explanation is necessary. If the second blow were made so that it falls outside the ridge of the metal forced up by the first blow, this second blow would drive some of the metal already bulged up back into the depression made by the first blow, and so with the third, fourth, etc.; thus, consequently, we should get only half results for each blow, we should, in fact, not get all the metal carried towards Z that we could get by the same number of properly executed blows.

In the example illustrated by Fig. 2, we have a portion of metal driven in the direction of Z; but we also have ridges of metal at E E, F F, the portions of the metal that have not been disturbed by each succeeding blow. Now it is really practicable, by directing blows at this point (letting the initial point of contact fall within this ridge), to drive the metallic particles away in all directions, and so to increase the dimensions of the plate, in which case, however, we have the plate thinner although larger.

The converse of this can partially be produced, the sheet of metal can be made thicker in certain parts. For example, suppose the metal is needed to be thicker at the part A (Fig. 3), it can be rendered so by a series of concentric blows as above directed.

It must be remembered that to produce this thinning and thickening of the metallic sheet that the metal may be laid on an anvil or some hard unyielding surface, and the blows struck with some instrument having a convex face. The blows in such cases are called solid blows. We shall refer to and explain this point later on.

If the surface on which the sheet of metal is laid was not perfectly hard, but of a soft or yielding nature, we should not accomplish the effect desired, or only so in a diminished degree, for the metal would be partially bent by the force of the blow, the surface of the sheet that received the blow being depressed, while the under surface (that of the soft bed) must be bulged out or become convex, and we should not have a ridge of metal raised up round the circumference of the blow.

To return to Cellini. The reason why Cellini commenced bulging it (the metallic sheet) in the inside, was because he wanted to get one portion of it thicker than the remainder, as he would subsequently have to raise that portion considerably above the ground (the "field," he calls it) of the design. Having got the portion he wanted as thick as needful, he struck it with the point of the hammer, but in the *inside* of the metal. In this we understand that he worked with a hammer that had a pointed tail, which he employed for the purpose of hollowing out the metal. This he did by turning the plate over and working on the "inside" by hammering the already thickened portion with the "point of the hammer," the result of such labour would be to raise the thickened portion of the metal considerably above the face or front side of the plate. Had he attempted to thus raise the figures for the "Father" from the metal without first having thickened that portion, he would have driven a hole through the metal. The tyro can easily verify this point by hammering a sheet of copper in one particular spot, the sheet of copper laying on a yielding bed. He will eventually find that a hole is made in the copper instead of it being bulged out the other side by the blows of the hammer. From these details of Cellini's method of working, we find that he did not confine himself to working on one side of the metal only, but that he worked from both sides of it; that is, he did not obtain the raised portions of the design by hammering of those portions that were not desired to be raised, but that he

brought up the raised portions by hollowing it out from the back; and to accomplish this properly he had first to thicken the metal in this part. In fact, with these early metal workers it was considered best to have the metal (both raised and untouched portions) of an equal thickness throughout after the finish of the design, not as is often found in modern repoussé work, the hammered portion thinner than that untouched by the tool. We thus learn one principle to guide us in working the metal. First principle: *Wherever a portion of the design has to be raised above the ground, first thicken this part of the metallic sheet, and then effect the raising of it by blows directed on the reverse side.* Although Cellini speaks only of an anvil in one case, but does not mention the form of bed in the second case, from subsequent details we know that he used a yielding bed on which to lay the metal when using the "point of the hammer" for forcing the metal out in a convex form.

From his description of writing we gather that Cellini would make the metal thickest where the cherubs were to be in "whole relief," less so where they were in "middle," and very much less so where they are in "low relief." In this the tyro will evolve a caution to be followed when thickening the plate in parts. *He must not take metal away from parts that have to be raised.* He must thicken the portion desired by gathering up the metal from those parts of the sheet that form the ground, or that will be untouched by the hammer or other tools. To know where these parts are, it is best to follow Cellini's method of working from a model, which was usually made in wax.

Great art and much practical work will be needed to become possessed of a full knowledge of the ductility of the various workable metals. We therefore suggest for the first lesson that the beginner take a sheet of copper four inches square, and in the centre raise a pyramid, and at each corner a convex hemispherical figure (see Fig. 4). In the production of the pyramid he can gather his metal from the spaces between the dotted lines, making that portion of the sheet thickest where the apex of pyramid is to be. In the hemispherical figures the metal can be gathered from the remaining triangular portions of the sheet.

A second point to notice in Cellini's description of his method of working is that where he observed that it (the metal) was too thick, in which case he worked with the punches on either side (of the metal). This working of the metal from either side, and with punches, was to correct the thickness of it. Then, suppose the second blow (see Fig. 2) of the hammer were not made at B (inside the circumference of A), but outside the ridge formed by the blow given at A, the metal at B would be driven towards A instead of towards C, as required; consequently, to correct this fault of the blow a third blow would have to be made, and this blow would have to be made at A again. As only the portion of the ridge near B is driven back, the hammer need not be used to strike the metal with, but a punch having also a rounded face, but one less or more (as the case needs) in convexity, and less in diameter than that of the hammer. This practical knowledge of the precise tool to use at the right time can only be gained by actual practice.

Caradosso da Milano—another worker in metal in the times of Popes Leo, Adrian, and Clement—was justly celebrated for his artistic workmanship; and his Holiness, having been caused to doubt Cellini's method of working, which was different from Caradosso's, asked Cellini, before he had quite finished the work, how he would manage to work out of the plate the little angels which were in the model, without spoiling that which he had already done. Our artist replied, "In the same manner as I had relieved the figure of the 'Father,' I should be able to bring up those of the angels—that is to say, bulging little by little the gold plate with the same punches on either side of it, till I had by degrees distributed the gold to where I found it was most required; that as there were some of them in very high relief, to bring them up to the required height I should have to treat them in the same manner as I had adapted in the figure of the 'Father;' but that as the others were in less relief, I should not have much difficulty with them, adding, that the greatest labour in working the above plate was in keeping the gold of even thickness. Leaving his Holiness thus satisfied, I departed to return to operate on the above work. I commenced with my punches, relieving the cherubs, which were in number fifteen, without having to solder in my work any cracks whatever. After having joined the gold between the heads, arms, and legs of these little figures, I began detaching them from the field and joining that part of the field which had been separated by the portions I had detached; and I then with great skill soldered them, adapting the method before mentioned of,* that is to say, making the solderings with stopping.

"When it occurs that works of so large a size have to be executed, the skilful artificer should be careful to put them into the fire as little as possible, for the prevention of their being soiled by the solderings, for, should any enamellings be required such solderings would interfere with their cleanliness. For this reason I got into order all the splits and all those

* I shall refer again, and explain what is meant by these "solderings" when detailing Cellini's method of working in silver.

parts that I had joined together, such as the arms, legs, and the heads of the figures, and when properly arranged I soldered the work in one firing, working thus, in four firings I managed to solder everything. The solderings being completed, I set myself to clean them carefully, particularly those on the field; and when I saw that these were clean, and quite equal in thickness, placing my work on the pitch, I worked at it with the punches; and as there were, as I have said, figures of infants in both high and low relief, and also another sort on the field of the work which had been wrought with only the large punches, I profiled the whole of them, and afterwards taking my work off the pitch, I well roasted or tempered it in the fire, and replacing it on the pitch with its bottom up, that is to say, burying the figure in the pitch (having for this purpose rendered some of the latter somewhat more stiff than I had it at first), I commenced depressing with the small punches (remember, since the face of the work is downwards this '*depressing* with the punches,' would in reality *raise* the figures on the face of the work) those cherubs which I had profiled from the face of the work, and forcing out somewhat more those which had to appear more forward than the others. Having done this, I took the work from the soft pitch and replaced it in the first or harder sort, then working it up to greater perfection."

For the benefit of those who have never done nor seen any repoussé work executed, more precise details about the use of these punches is necessary. We notice that in the first place Cellini bulged the metal into thicknesses where required by hitting with the face of the hammer, then turning over the sheet of metal he hollowed out this thickness for the remainder of the sheet by blows from the "point" of the hammer. Having thus roughed out the design he proceeds with various sized punches to beat down some portions of the metal—for which purpose he hits the face of the metal—and other portions he hollows out by hitting the back of the sheet. For example, he proceeds to outline the profiles of the cherubs' faces by hitting the metal on the front; when having indicated the outline of the features by a series of contiguous indentations made by hitting a certain size punch, he turns the sheet of metal face downwards on a soft bed of pitch, and with larger and different sized punches, as the work requires it, proceeds to hollow out the contours of the face, the rounded cheeks, the prominences of the forehead, etc.; then, replacing the metal face upwards, he adds the finishing touches, such as indicating the expression given by the corners of the mouth, the setting of the eye, the form of the nostril, etc.

(*To be continued.*)

MODEL ENGINE-MAKING.

By JOHN POCOCK.

VI.—Top and Bottom Covers of Cylinder—Tenon Piece on Bottom—Chucking Cover—Chuck—Recess in Cover—Top Cover—Hole in Stuffing-Box — Glands for Stuffing-Box — Valve Chest—Valve Gland.

THE bottom cover of the cylinder should be turned before the top cover, since it is not so necessary that the former should fit the cylinder exactly, as it is that the latter should be a perfect fit.

If a chucking tenon has been cast on the cylinder bottom, the chucking will of course present no difficulty. It may be held in a self-centring or grip chuck, or a chuck may be made once for all by boring out a gun-metal chuck to the proper size, and tapping it with a screw which need not be a very fine one; the tenons may then be all screwed to fit this chuck, so that if said tenons have been properly cast, most of the turning work may be done with the one chuck.

If there is no tenon piece, the chucking of the cylinder bottom will be less easy a matter, but here, as is often the case, the simplest method will be found the best. Care must, however, be taken to perfectly fit the cover to the chuck before beginning, for there are few things more annoying than for a piece to work loose in the chuck just as it is half turned, and to keep coming out during the remainder of the operation.

To chuck the cover, take a piece of suitable wood—beech is good, boxwood preferable, but when nothing better was at hand, the writer has often used deal, and made it serve the purpose well enough—in fact, Fig. 59 is an exact representation of a cylinder cover at the present moment before the writer's eyes, chucked in an odd piece of $\frac{3}{4}$ inch deal board, screwed to the face-plate by two ordinary wood screws passed through holes in the face-plate and into the wood.

However, to return to the chuck we are about to make—the piece of wood chosen need not be over $\frac{3}{4}$ inch thick and $2\frac{1}{4}$ inches in diameter; it should be screwed to the face-plate with two or three ordinary screws; and if the face-plate is not already provided with the necessary holes, it will be found very convenient to bore half-a-dozen at different distances from its centre—these holes being about $\frac{3}{16}$ inch in diameter, and slightly countersunk at the back of the face-plate to take the heads of the screws.

The wood for the chuck being firmly attached to the face-plate, and the latter screwed on the lathe mandrel, a recess of $\frac{3}{16}$ inch deep should be turned in the centre, and this recess must be gradually enlarged until it is nearly of the same diameter as the cylinder

cover. The edges may be very slightly undercut. When the cover will all but go into the recess turned in the wood, the face-plate, with chuck attached, is to be taken from the lathe and laid on the bench, and the cylinder cover driven into the recess by a few light blows from a mallet, taking care to place the cover with its outside towards the wood, so that the inside may first be turned.

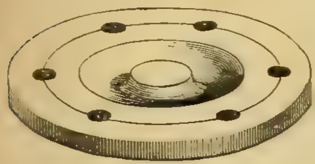


FIG. 60.—CYLINDER BOTTOM FINISHED OUTSIDE.

As to the process of turning, light cuts only should be taken, and the centre of the cover should be left projecting about $\frac{1}{16}$ inch, the projection being of such a diameter as to fit the bore of the cylinder exactly.

When finished, the cover must be taken out of the chuck, and a recess turned in the lathe for the reception of the projection in the centre of the inside of the cover; the cover is now to be replaced in the wooden chuck in the same manner as before, but in a reversed position for the turning up of the outer surface.

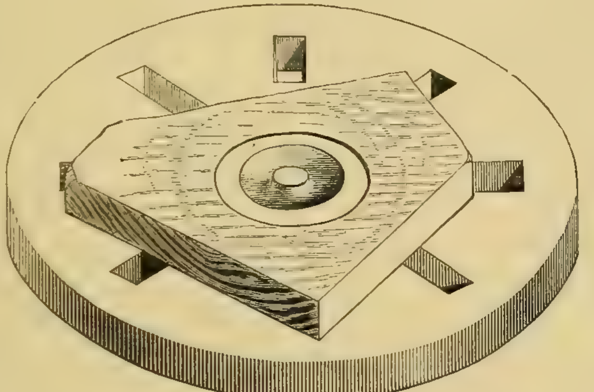


FIG. 59.—CYLINDER COVER IN WOOD CHUCK.

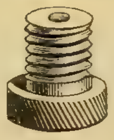


FIG. 63.—GLAND.

To do this, turn up the flat part first, and slightly mark upon it with the graver a circle $1\frac{1}{4}$ inch in diameter. Without removing the piece from the chuck, draw a line through its centre, and when this line cuts the circle just mentioned, centre punch and drill two holes $\frac{3}{32}$ inch in diameter. Now pass two $\frac{1}{2}$ in. wood screws through these holes, and screw firmly down to the wooden chuck, after which the centre and hollow portion of the cover may be turned. When the surface is finished, the chuck itself must be turned away until the edge of the cover is free, and then the cover being still held to the chuck by the two screws, the edge is to be turned down until it exactly fits the cylinder flange. Fig. 60 shows the outer, and Fig. 61 the inner surface of the finished cover.

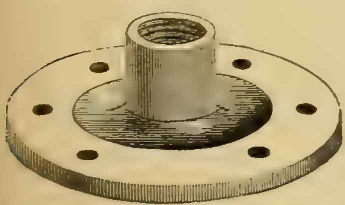


FIG. 62.—CYLINDER TOP AND STUFFING-BOX—FINISHED.

The top cover is to be turned up in much the same manner, the underside being turned first. Of course, a deep recess to hold the stuffing-box (which is cast on to the top of this cover) must be turned in the chuck in the first instance. The top being reversed in the chuck, the stuffing-box will, of course, be turned up after the flat part has been turned, and the piece screwed down to the chuck.

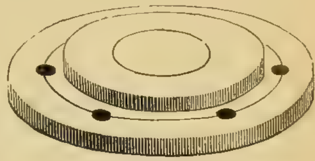


FIG. 61.—CYLINDER BOTTOM FINISHED—INSIDE.

Now while the cover is still in the lathe, drill a hole $\frac{5}{32}$ inch in diameter through the centre of the stuffing-box, and enlarge this to $\frac{5}{16}$ inch to within about $\frac{1}{8}$ inch of its inner side. Tap the stuffing-box with a tolerably fine screw thread, and the top cover is finished with the exception of the screw holes. To drill these holes, by which the cover is to be secured to the cylinder, hold the cover in place upon the cylinder and mark upon the latter the position of the two screw holes already drilled through cylinder cover—centre punch and drill them through the flange with a $\frac{1}{16}$ in. drill, tap them, and screw the cover on with $\frac{3}{32}$ inch screws. Now divide the circle marked on the cover into three equal parts on each side of the two screws; centre punch at the four points of division thus found, and drill right through both cover and flange with the $\frac{1}{16}$ in. drill; unscrew the cover and tap the four holes in flange, and enlarge those in cover to $\frac{3}{32}$ inch, and the cover will be then ready to screw on. These instructions will apply equally to both top and bottom covers.

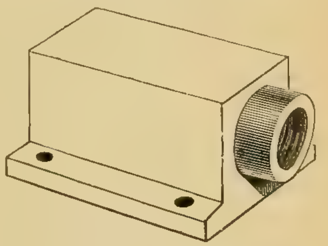


FIG. 64.—VALVE CHEST—FINISHED.

In the set of castings now under consideration, the gland for cylinder stuffing-box is cast in one piece with the gland for the slide valve-chest, and we shall therefore leave the fitting of it until after the valve-chest has been finished.

The valve-chest will be our next care; the edges of the flange should first be filed up square to fit cylinder face.

If the valve-chest has no chucking tenon (and it has none in the set of castings now before the writer) the centre of the stuffing-box must be found and marked, and then the chest being laid on the surface plate or lathe bed, a scriber must be set to this mark, and the chest being reversed, a line is to be drawn across the back of it with the scriber. The chest is now to be set up on the edge of its flange, first on one side and then on the other, each time setting the scriber and marking the back of chest, centre punch the position thus found upon the back of the chest, drill slightly, and mount the chest between the lathe centres. The stuffing-box is now to be turned up, and the chest being then taken from the lathe, a $\frac{3}{32}$ inch hole is to be bored through the stuffing-box, and enlarged to $\frac{1}{4}$ inch to within $\frac{1}{8}$ inch of the inside of the valve-chest.

Now take the piece from which the two glands are to be formed, and centre mark and drill a $\frac{3}{32}$ inch hole right through it. This hole may at once be enlarged to $\frac{5}{32}$ inch through that portion of the piece which is to form the gland for cylinder top. Mount the piece between centres with a carrier upon one end, and turn up the other end to the full diameter of the bottoms of the threads of stuffing-box it is to fit; now reverse the piece in the lathe, so that the carrier may be placed upon the end already turned, and turn the other end to fit the other stuffing-box; the flanges of the glands should be turned to a diameter about quarter inch larger than their respective stuffing-boxes, and a portion of the metal between the two glands may at the same time be turned away, but care must be taken not to separate the glands, which must next be screwed to fit the stuffing-boxes. Now screw the valve gland into its stuffing-box as far as it will go, and mount valve-chest and glands between lathe centres, mill the flanges with a milling tool, and cut off the cylinder-cover gland, turning up its face at the same time. When this gland has been cut off, bring the back centre up again, and cut off the superfluous piece of metal left on the top of the valve-chest gland, and the glands will then be finished. The valve-chest may now be filed up square and smooth all over; the holes for the screws should be drilled $\frac{1}{8}$ inch from the edge of flange, and $\frac{3}{16}$ inch to $\frac{1}{4}$ inch from each end. One hole $\frac{3}{32}$ inch in diameter should first be drilled through the flange of the chest, the position of this hole marked upon the cylinder face, and a hole drilled therein with a $\frac{1}{16}$ inch drill; this hole is to be tapped, and the valve-chest screwed to cylinder face, and carefully set square with the cylinder, so that the piston rod and valve cylinder when in place may be exactly parallel. The other three holes are now to be drilled with a $\frac{1}{16}$ inch drill through both valve-chest and cylinder face, being afterwards enlarged to $\frac{3}{32}$ inch in the former, and tapped with screw thread in the latter, as in the case of the cylinder covers.

(To be continued.)

A PHOTOGRAPHIC ENLARGING CAMERA:

ITS CONSTRUCTION AND USE.

By CHAS. A. PARKER.

IV.—ENLARGING UPON CANVAS—SENSITIZING CANVAS —DEVELOPING, ETC.—CONCLUSION.

LET us now turn our attention to enlarging upon canvas. It is now becoming the custom for the painter to set up his prepared canvas, and project an image of the desired size upon it from a small negative, and guided by this image, working it into a painting exactly the same as if it had been a sketch done in pencil. By this means he is enabled to turn out a much more artistic picture, at the same time keeping faithfully to the likeness. As there may be some of my readers who may like to try this process, I will give simple directions for preparing the canvas, etc. Get some canvas on stretchers of the required size from any artists' colourman (Reeves and Sons, and Messrs. Robertson's are the best). Do not get it of too dark a tint, and if it is already painted or primed it will be unsuitable. The canvas must now be washed with soap and warm water, then swill it well with an abundance of cold water, drain it well, and rub it dry with a clean linen cloth, after which the canvas is to be stretched so that there are no folds or creases, and allowed to dry. Now make up the following solution:—

Bromo-Iodide Salting Solution.

Bromide of potassium . . .	3 parts.
Iodide of potassium . . .	1 part.
Bromide of cadmium . . .	1 part.
Water	240 parts.

Pour some of this solution into a tray a size larger than the canvas. Now take four $\frac{1}{4}$ inch iron tacks, and drive one in half its length at each corner of the canvas, and then place it face downwards in the tray containing the above solution, until it is thoroughly saturated, when it should be removed and placed in a warm room to dry. When dry it is rendered sensi-

tive to light by placing it in an acid solution containing nitrate of silver, which is prepared as follows:—

Sensitizing Bath.

Nitrate of silver	4 parts.
Citric acid	1 part.
Water	140 parts.

The canvas is sensitized in the same manner as described above, by placing it face downwards in a tray containing the solution, being, of course, sensitized, and placed to dry in a dark-room. It is ready at any moment, when dry, to be exposed and developed, which is performed in exactly the same manner as when making an enlarged positive on paper. A distinct outline should be visible before development.

Fill a developing tray to the depth of a quarter of an inch with the following developer, which should be slightly warmed before use :—

Developer.

Pyrogallic acid	10 parts.
Citric acid	45 parts.
Water	410 parts.

The picture should be properly out in ten minutes or so ; give it a thorough washing after the development ; the image can be toned by employing the same toning bath as is used for prints on albumenised paper, say, for instance, the ordinary acetate bath, which I have found to work very well. After the canvas has been toned it can be coloured in oil exactly the same as if it had been a sketch done in pencil, the resulting picture being a more correct likeness than could be possibly drawn.

There remains but little for me to say with regard to the various methods of enlargement beyond what I have already put forward, but a few closing words of advice may be useful to those who wish to turn out the best work. For me to give gratuitous advertisements to the manufactures of a particular firm would hardly be fair to others. The various articles required must, therefore, be purchased after having looked over everybody's catalogue, and listened to the various suggestions held out by our photographic friends. One will be found to praise one make of plates or paper, while another magnifies some one else's brand, and a third, after having been dabbling about in hypo, pyro, or silver solutions, gives his hands a wipe on the focussing cloth, and then sets about making an enlargement, and ends by "blessing" (?) the maker who sent him paper full of black stains and smears; and, to make matters worse, advises his friends not to use any of that particular make, overlooking the fact that it is impossible to do good work without method.

The bromide paper at present in the market (of any good maker) is capable of yielding splendid enlargements, but it needs to be correctly exposed, properly developed, and cleanly and carefully handled, and then the "amateur" will rise to the true meaning of the word—one who acts skilfully in the art that he studies: another point of great importance is to adhere strictly to the "prescription" accompanying the paper or plates, which the maker has carefully tested and found to give the best results with his especial plates, and not with those of a lot of other makers ; although the only difference in many of the various formula is in the weight of the chemicals used, and very often a modification of one developer will be found to work well with almost any make of paper if it is intelligently used—that is to say, weakened or strengthened to suit the paper.

It is perfectly astonishing the number of amateurs who will (for dry-plate work) stick to one developer, and because it does not work well with all makes of plates, they declare them to be very bad and try another make, with generally the same result, and wind up by saying that photography is very difficult to practise, which is perfectly true, if there is a disinclination to use the brains that Providence has endowed us with ; but, on the other hand, great praise is due to some amateurs for the excellence of their productions, which in many cases show such a fine chemical manipulation and artistic finish, as to almost rival that produced by the professional.

More of the failures in amateur photography might be traced to the dark room than any other cause. Professionals are well off in this respect ; but amateurs are obliged often to put up with anything they can get. I can remember a time when I had to content myself with temporarily converting a sleeping apartment into a dark room, and I found it rather difficult to do so without raising the ire of the feminine portion of the household, who anything but appreciated the manner in which that "nasty photographer" handled blankets, sheets, counterpanes, etc., in his endeavours to block out all the actinic light, without counting the "squaring" necessary for damage done to toilet mats, carpets, etc., by the hypo.

As many of the above remarks may appear trivial or unnecessary to some, I would remind them that it is by attention to minute and apparently trivial matters that the greatest successes are attained. I would also urge the amateur to bear in mind that every failure is a step towards success.

Those who care to study the various methods and modifications in working the numerous photographic processes, cannot do better than read the pages of the three photographic journals—namely, the "Photographic News," the "British Journal of Photography," and the "Amateur Photographer." The first two

named publish yearly "almanacs" which teem with information, and accounts of new processes evolved from the brains of the greatest living photographers, together with concise and interesting resumes of the progress of photography during the past year. The "Amateur Photographer," published weekly, price 2d., is about the best for an amateur to subscribe to: it is an excellent medium for the diffusion of information on the manipulations and processes of the art-science of photography, prizes being offered from time to time for the best specimens of amateur work. I have now brought this paper to a close, feeling confident that if the amateur will bestow on the various processes described due care and attention, his efforts and mine will be amply repaid.

A SIMPLE CONTRIVANCE FOR GRINDING SKATES IN THE LATHE.

By SEMPER PARATUS.

IN making this my first appearance before the readers of AMATEUR WORK, I may say that I reside in the Lake District, where a large proportion of its inhabitants indulge in that healthy, invigorating exercise, skating on the many lakes which surround them. And as many pairs of skates come to my employer, who is an ironmonger, the clumsy and unsatisfactory way we had of grinding skates on an emery wheel, without a rest of any kind, led me to contrive the following appliance to a lathe of the commonest description in our workshop, which has been a complete success. So if there is any enthusiastic skater who is a subscriber to AMATEUR WORK, and who has felt the want of his skates wanting grinding, by following the directions given, with the aid of the diagrams that accompany this paper, he will no doubt be able to make as good, if not better, attachment to his lathe as the one from which the design is taken.

I must suppose that all who wish to make this contrivance is possessed of an emery wheel of about 4 inches in diameter; if not, one can be bought of Messrs. Churchill and Co., 21, *Cross Street*, *Finsbury*, *E.C.*, for 4s. 6d., which ought to be 4 inches in diameter and 2 inches thick for efficient work. It must be mounted as shown in plan at Fig. 1, with shouldered spindle and nut with turned washer. The emery wheel may be driven by putting a carrier on the plain end of the spindle and by using catch plate, or as I have shown in the diagram given, by means of a drill chuck.

Having considered the mode of mounting, now for the forgings. Get the nearest blacksmith to forge you an H-shaped piece of iron to the dimensions given in Fig. 3, ¼ inch thick. File the two outside edges smooth, then get the smith to bend the two arms across the dotted lines marked at right angles so as to form two T-rests parallel to each other. Now get a piece of round iron bar that will go into the socket of the T-rest of your lathe. Turn a shoulder on it to fit a hole ½ inch in diameter in the centre of the parallel rests marked C in Fig. 3. Heat it red hot in the fire, then put it through the hole and rivet in vice.

Now get a similar shaped piece of iron forged at the smith's to the sizes given in Fig. 4. Take a skate with you, get him to bend the two arms to the shape of Fig. 5, with just sufficient space between the ends of the arms A, B, C, D, so as to allow the thickest skate iron to go through without a great deal of play. You can try your skate until you think it right. Now you will have to make a long armed screw of the shape of Fig. 6, tap it with a ½ inch Whitworth thread, and bore two holes right through the thickened part marked A in Fig. 6. This is to screw the skate tight up against the pincer-like jaws of skate-holder, Fig. 5. Tap a hole in the centre of the holder to fit the above screw, the hole to receive which is marked E in Fig. 4.

The whole appliance is now made and is perfectly ready for use.

In order to use it, put the parallel T-spindle into socket of hand-rest; bring T up to within ⅛ inch of emery wheel, and parallel with its spindle. Now insert a skate into the skate-holder, screw it up tight with the long-handled screw. Lay the blade of the skate on top of the T-rest next the emery wheel, and let the handle of screw lay on back of T, as shown in Fig. 2.

Now set the lathe in motion, bring the heel or toe of skate to the emery wheel, grind it for a short time, and then take it off and see if it is grinding the centre of iron more to one side than another. If the latter, the clamping will have to be released, and the position of skate altered a little until it grinds the skate iron right in the centre, and gradually extends to the outside edges. Now gradually carry it along until the whole of the iron is ground to your satisfaction. If the skate get a little hot during the process, dip it now and then into a shallow dish of water.

I will conclude my paper with the hope that those who choose to make the contrivance will be as successful in grinding their skates as I have been, and if I have not explained any portion sufficiently, I shall be glad to answer any questions in "Amateurs in

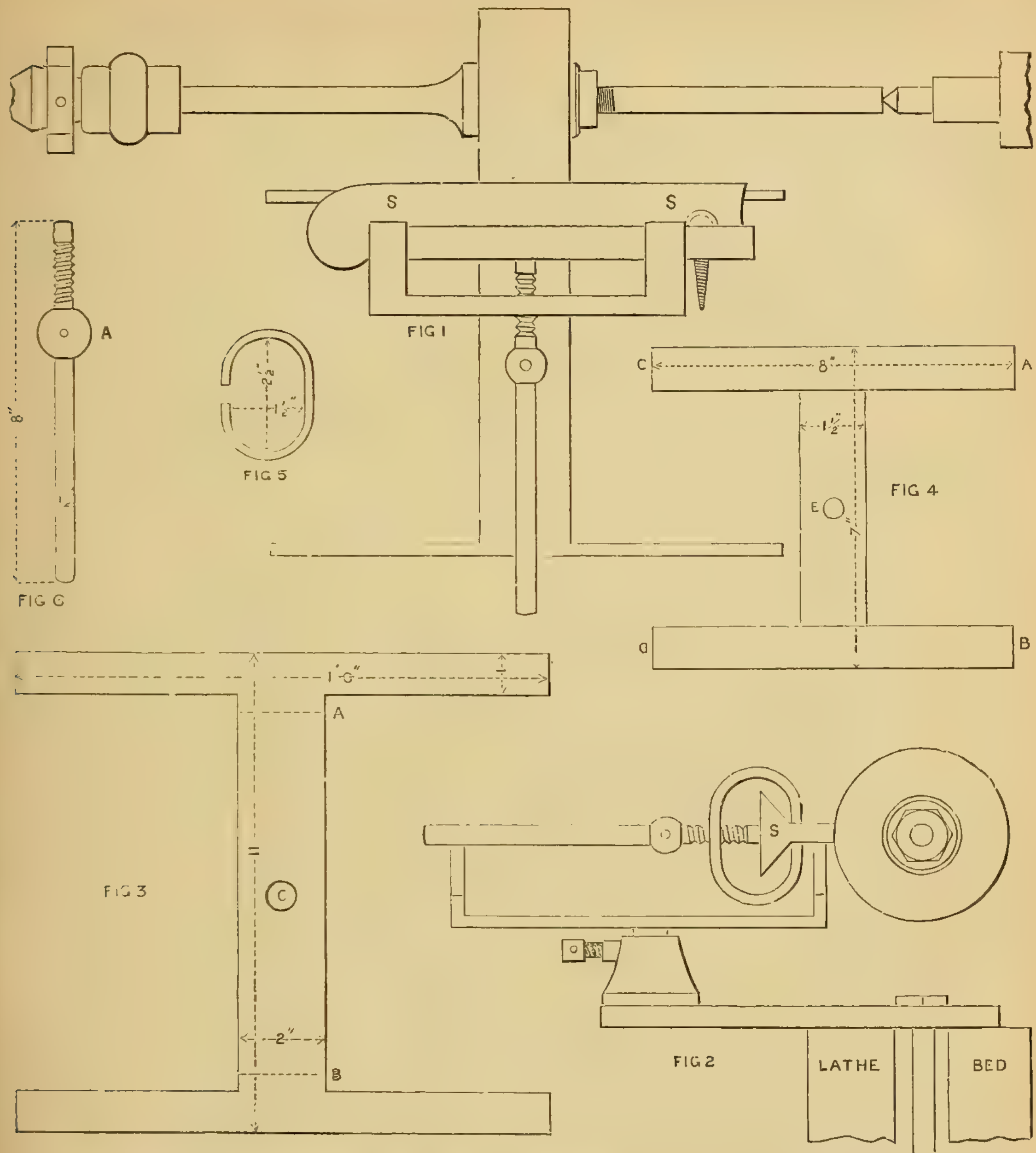


FIG. 1.—MODE OF MOUNTING EMERY WHEEL WITH SKATE, S, IN POSITION FOR GRINDING, SHOWN IN PLAN. FIG. 2.—SKATE ON LATHE IN POSITION FOR GRINDING, IN SIDE ELEVATION. FIG. 3.—H-PIECE OF IRON FORMING REST. FIG. 4.—H-PIECE TO FORM SKATE-HOLDER. FIG. 5.—FORM IN WHICH ARMS OF SKATE-HOLDER MUST BE BENT. FIG. 6.—LONG-ARMED SCREW TO FIX SKATE IN SKATE-HOLDER.

Council." I do not, however, anticipate that anyone who is disposed to make trial of my method will find any real difficulty in making the necessary fittings and appliances and carrying out the process described above, by which the process of grinding is effected. It has, I venture to think, the merit of simplicity to recommend it, and I may add, that the results obtained and the celerity with which the grinding is done, will be found to compensate for the trouble taken in making the fittings. I had almost forgotten to say that all the drawings are drawn to quarter size, or on a scale of 3 inches to the foot. To prevent any mistake I have appended in the diagrams the sizes of all the parts necessary for the appliance.

ENCAUSTIC PASTE FOR MOUNTING PHOTOGRAPHS.

By JOSEPH HARRIS.

IT is generally admitted that given a photograph printed in the ordinary manner on albumenized paper, and passed through the various stages with due care, it will conduce to the preservation of that photograph, if the surface be protected from atmospheric influence by an encaustic paste.

Another advantage secured by this use is, the shadows of the picture gain in richness, transparency and brilliancy, thereby adding to their *depth*, while the detail in the lights is brought out with improved distinctness.

On the subject of paste, a reflection—what a sad imitator is the human biped!

The formula for making encaustic paste, according to the use of Adam Solomon, was published many years since. The various guide-books repeat this publication at indefinite intervals of time. And with such success, that does any writer desire to inform concerning encaustic paste, he at once resorts to the well-known pure white wax, 500 parts; gum elemi, 10 parts; benzole, 200 parts; essence of lavender, 300 parts; oil of spike, 15 parts.

What is oil of spike? Procure a dozen samples from different houses, and the probability is, they will all differ in odour and in colour! Every writer adopts the "oil of spike" without comment, but would it not be advisable to obtain the real "oil of spike," and ascertain its properties before counselling its use; and while we await with interest the publication of the result of this most profound study, suppose we combine the last two items of the receipt, reading them—

Essential oil of lavender . . . 320 parts.

To return to the formula. Some of our friends, the guides, advise "powdering the elemi, dissolving it in the solvent, using gentle heat." Unless the heat be of a *more gentle nature* than is usual with heat, this will be rather a critical operation with such an inflammable agent as benzole.

Does the writer recommend pouring the benzole with the *powdered* elemi into a saucepan, and holding the aforesaid saucepan at a sufficient height from the fire, to secure the heat which is "gentle." At what distance from the fire is the benzole to be kept, because the result of this experiment is apt to be the very reverse of a gentle one, especially as regards the experimentalist.

The virtue of the tea-leaf may be departed, so says the song, but there is left—the cup of tea. The virtue from the sample of elemi has dried up, and there is left a useless substance which must be "pounded" to fit it for solubility, and the compound filtered to extract the grains which refuse to "solubilate." But why select a dried-up sample of this gum from some humble Galen who has no sale for the article? In its *normal* condition, elemi is a moist gum dissolving readily in benzole; *without the aid of the kitchen fire.*

To make the paste, shred the wax and melt it over hot water, dissolve the elemi in the benzole, pour the melted wax therein, stirring the while with a glass rod. Add the essential oil, stir, place the whole in a jar to cool.

With a small portion of new flannel, take a little of the paste, and apply to the photograph on a few places, rub lightly to distribute over the surface; use a second piece of flannel to polish by a light, quick, and circular motion, till a most brilliant surface be attained.

A USEFUL CABINET FOR COINS.

By Rev. A. THOROLD, M.A.

COLLECTIONS, of whatever kind they may be, would be uninteresting and tedious affairs, unless accuracy, in their arrangement went hand in hand with good judgment in their formation. Suitable drawers or cabinets are therefore from the first, absolute necessities. Without such arrangements for the reception of the specimens, injuries of every description would mar and probably at last ruin the fruit of the most patient toil.

There are almost as many different kinds of cabinets as their are varieties of collections. The entomologist, the botanist, the numismatologist, have each their several arrangements, without mentioning any others. It is intended, however, in this paper to explain the sort of cabinet used by the numismatologist, or collector of coins; and, if requisite, a few more pages can be afterwards devoted to the needs of any other of the scientific persons before mentioned.

The chief distinction between this particular class of cabinet and others, consists in using slides instead of drawers for the reception of the coins. A very considerable saving in space is thus effected, and a collection of fair magnitude can be stowed without undue crowding between the sides of a cabinet, which for any other collection would appear crampy and insignificant. Cabinets for the reception of coins are somewhat costly affairs, since the amount of work in their manufacture is out of apparent comparison with their appearance.

The numismatologist, therefore, who is also an amateur carpenter, will appreciate the difference in expenditure between his own and a purchased case, and even if his outlay should equal what he had expected to expend on the contemplated purchase, he will, if he should so please, be able to provide himself with a far larger cabinet for the same money.

We will suppose that the desired cabinet is for the reception of a collection of some magnitude, and that amongst the specimens are selections in the three general metals used in ancient and modern currency alike—gold, silver, and copper.

Of course, we might follow a common plan, and place this collection in an ordinary case containing a single set of slides; but for the better classification of the coins into periods, as well as into their respective kinds, it is far preferable to have a three-fold cabinet, and so entirely avoid all intrusion of one metal upon another. Fig. 1 shows the cabinet suggested. The construction of this cabinet will not appear at first sight a very great undertaking, but at the outset it will be well to state plainly that some nicety of workmanship is needed. Unless, for instance, the slides are carefully made, they are apt to curl; unless the grooves and rabbetings are accurate and strictly in proportion, not only will the slides stick, but on being pushed in, will not fit down closely upon each other in front. It is a most desirable thing to keep the dust out, but ill-fitted slides will, it is plain, fail in the very particular for which they are required at all.

The cabinet itself is a plain strong mahogany case, with dovetailed sides, and standing on round feet, in length it measures 33 inches, in depth 11 inches, in height 14 inches. The bottom of this case should be grooved or rabbeted, see Fig. 2, to the exact size of the sides, thus allowing them to be "housed in" upon it, and with the addition of a little glue, nothing can be stronger. The case itself is divided into three equal parts by the two divisions A and B (Fig. 1), which must be rabbeted into the back and bottom. The top C opens upwards, being hung on hinges at the back, like the lid of an ordinary box. Fig. 3 gives this plain case with the lid raised, showing the strip D, which running across from corner to corner carries the upper edges of the two divisions A and B. In D at E is a small lock by which the lid is fastened down.

Fig. 4 shows one of the slides.

They are all alike excepting in their depth, and the size of the nests for the coins.

It is desirable to vary the depth of the slides from $\frac{1}{2}$ inch to $\frac{3}{4}$ inch, and so allow room for thick as well as thin coins.

The slide shown is a panel of mahogany, the grain running from front to back.

Upon the front and back of this panel, $\frac{1}{2}$ inch strips or fillets, A A, of mahogany are rabbeted to keep it from warping and carping. (See Fig. 4.)

The edges of the panel must also be rabbeted half-way through to run in the grooves, to be spoken of presently (see Fig. 4, showing side). But this rabbeting should be done before the front fillet is fastened on since the extremities of the latter are left solid to form a stop to the rabbet. We now proceed to make the nests for the coins.

Mark out a card or paper as in Fig. 5. Place this template on the slide, marking through with an awl at each centre, then with a good bit remove the wood to rather more than the thickness of the coins, and slip in a circle of green baize to form a finish, and a soft bed for the coin.

We now return to the case. Fig. 1 shows this as it appears when finished, but it must not be put together till the grooves in which the slides are to run have all been carefully rabbeted out. Figs. 6, 7, and 8 show sections of a side and division with these grooves. Great care must be taken to get the corresponding grooves strictly opposite to each other. Before, however, we proceed to cut the grooves for the slides, the front edges of the sides and division A and B (on both sides) must be rabbeted from top to bottom $\frac{1}{2}$ inch deep, and $\frac{1}{2}$ inch wide, Fig. 9. By this arrangement the front fillets of the slides, B, Fig. 4, will fit up against the end of the grooves, E, Fig. 9, in which the slides run and present on the outside an unbroken and uniform appearance (see Fig. 1). Unless this plan be adopted the grooves in which the slides run will come through to the front and look unworkmanlike and awkward.

E, E, E, Fig. 1, are not slides, but small drawers, in which it will be useful to keep duplicate coins, labels, washleather, and other odds and ends. G, G, G, Fig. 1, are strips $\frac{3}{8}$ of an inch wide, and $\frac{1}{2}$ inch thick, which must be rabbeted into the sides and centre uprights, A and B, below the lowest of the slides, to form a division between them and the drawers underneath. Fig. 10 shows the front of the cabinet again, but with a device for preventing any of the slides being pulled out excepting by the right person. In the thickness of the cross-piece D, $\frac{1}{4}$ inch from the front edge, three holes $\frac{1}{8}$ of an inch in diameter must be bored at L, M, N. These holes run through all the slides, and a short distance also into the bottom of the cabinet. Now prepare three brass rods, in length measuring from P to Q, in Fig. 10, each with a small knob or head (see Fig. 11).

To close the cabinet drop these rods into their respective passages, shut down the lid, which must have been countersunk at Q, Q, Q, Fig. 3, to allow it to cover the heads of the rods and lock it. It will, of

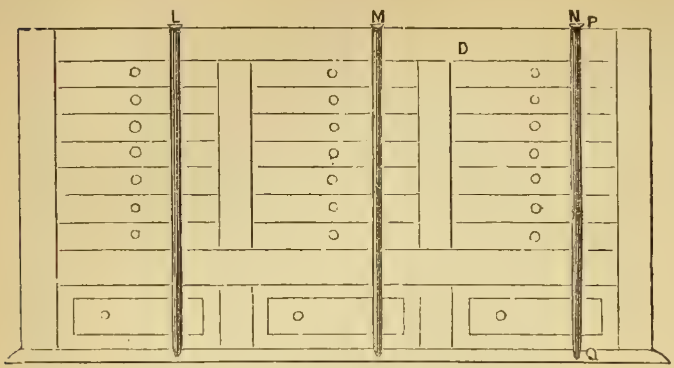


FIG. 10.—MODE OF SECURING SLIDES BY RODS.

FIG. 11.—ROD WITH KNOB AT END.

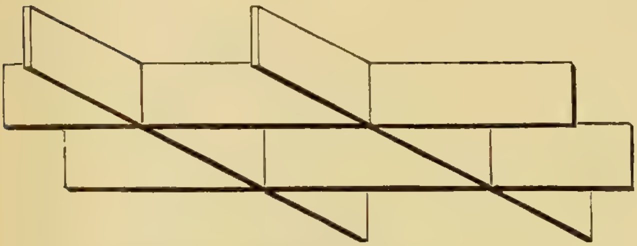


FIG. 12.—MODE OF DIVIDING DRAWERS FOR BIRDS' EGGS.

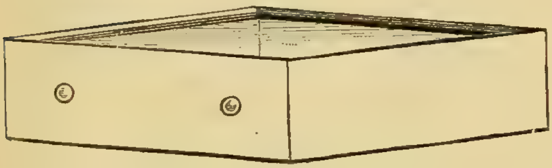


FIG. 14.—DRAWER FOR CABINET.

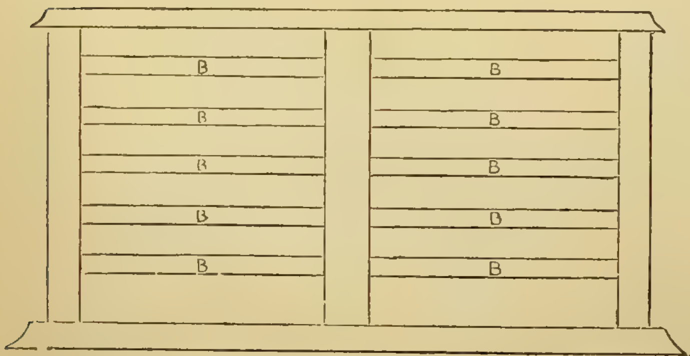


FIG. 13.—EXTERNAL APPEARANCE OF CABINET FOR EGGS, WITHOUT DRAWERS.

course, be found impossible to remove the slides till the lid is unlocked and the rods removed. In each slide, Fig. I is a small handle of turned brass or wood. K shows a brass fitting into which a card can be slipped, bearing name of country, period, etc., or a small tablet of bone or ivory may be fastened on, and the name written in ink or pencil.

When carefully polished the cabinet will be ready for use, and present a handsome and imposing appearance.

It is possible, however, as suggested at first that other collectors besides those

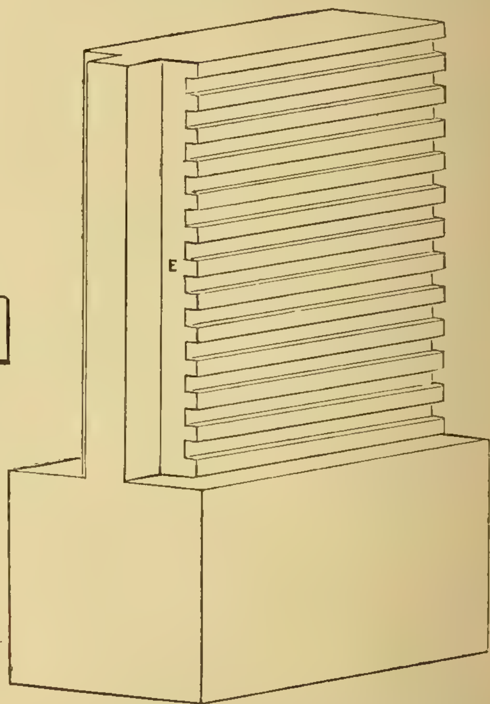


FIG. 9.—DIAGRAM ON LARGER SCALE TO SHOW METHOD OF GROOVING SIDES AND DIVISIONS.

whose hobby is coins, may be thinking of setting their hands to cabinet making. In case this should be so, it may be as well before closing this paper to give a few hints on cases suitable for both the entomologist and the egg collector. For either of these the tray or slide just described must, of course, be discarded, and drawers substituted in their place.

It will be advisable also to dispense with one of the divisions, and thus provide for two sets of drawers instead of three. For insects the drawers should

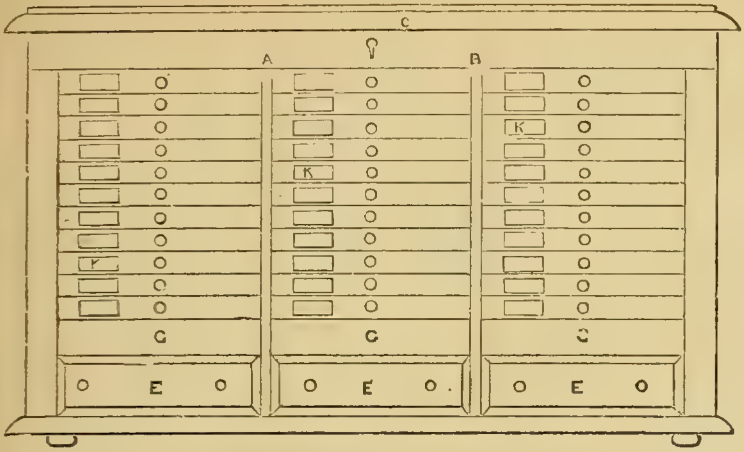


FIG. 1.—FRONT ELEVATION OF CABINET FOR COINS.

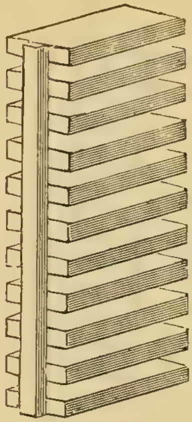


FIG. 8.—
PERSPECTIVE VIEW
OF DIVISION.

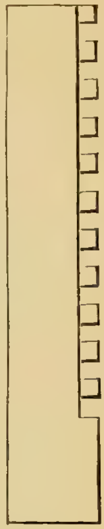


FIG. 6.—
GROOVED END
IN SECTION.

FIG. 5.—TEMPLATE FOR NESTS FOR COINS.

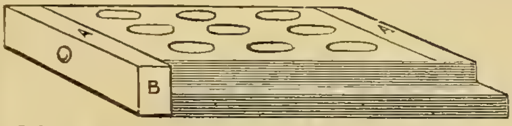


FIG. 4.—STRIPS OR FILLETS OF MAHOGANY ON PANEL.

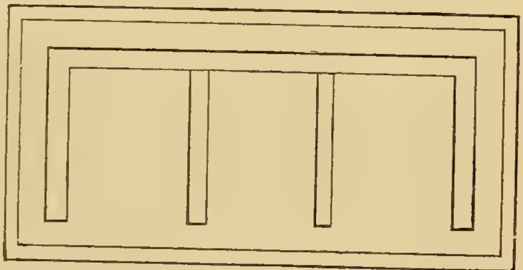


FIG. 2.—GROOVING OF BOTTOM OF CABINET.

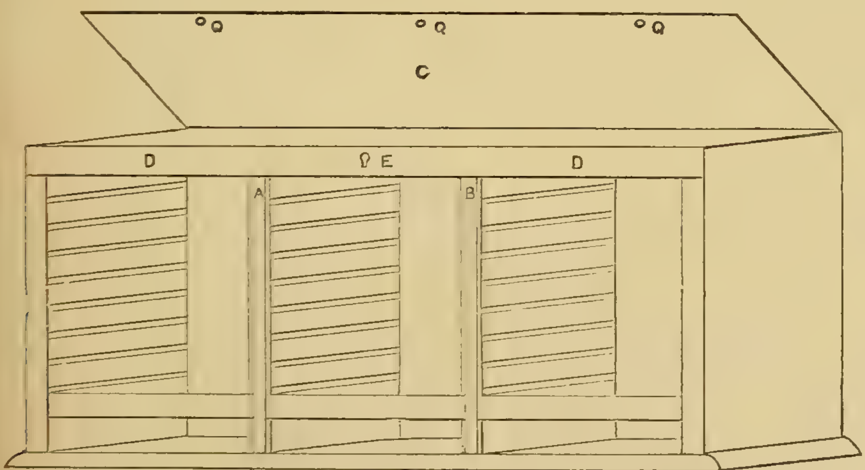


FIG. 3.—PLAIN CASE WITH LID RAISED.

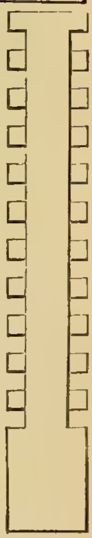


FIG. 7.—
GROOVED
DIVISION
IN
SECTION.

be $1\frac{1}{2}$ inch deep, but for eggs they should vary in depth from 1 inch to $3\frac{1}{2}$ inches, the deepest being kept at the bottom.

These drawers, for whichever purpose they are to be used, must run in grooves rabbeted out as before ; or, if preferred, on runners, or strips, fastened at intervals upon the inside face of the sides of the case; strips fastened on are preferable.

The drawers themselves should be light, and be neatly dovetailed together, and if to be used for insects, a groove should be rabbeted all round the top edges to allow a square of glass to fit in tightly, for the purpose of excluding as much air and dust as possible. The bottom also must be lined with sheet cork to give the pins used an easy entrance and secure hold. It will be advisable to cover the cork with thin white or coloured paper.

If the drawers, on the other hand, are to be used for eggs, it will be necessary to divide them into partitions, using thin slips of wood halved together for the purpose, as shown in Fig. 12. The size or area of these partitions should vary with the depth of the drawers, more or less room being allowed as the drawers are intended for large or small eggs respectively.

Fig. 13 shows the outside appearance of the cabinet above described, but without the drawers, in which B B are the horizontal divisions between the drawers, running parallel with the strips, over which the drawers slide. Fig. 14 shows one of the drawers. It will be found advisable to insert two knobs or handles in each drawer instead of one, since the wider the drawers are the more likely they are to catch when pulled out.

Be very careful to use seasoned wood. It is not usual to lock these cabinets. If desired, however, the same sort of fastening can be made use of as already described ; but if it is not considered necessary, the top or lid of the case should be fastened down upon the sides, and not hung on hinges as in the cabinet for coins.

Shells or minerals can be safely kept in a case similar to that described for eggs, the depths of the drawers and the size of the divisions being varied in the first instance, however, as found requisite and convenient.

The making of a case or cabinet as described above, whether for coins, or birds' eggs, or shells, or minerals, or for butterflies and moths, or, indeed, for any objects that can be conveniently stored and preserved in such a contrivance, will be found to afford excellent practice in cabinet making for the amateur workman, and if he find he can turn out this in a workmanlike manner he may safely attempt the making of still more ambitious articles of furniture.

THE MAGIC LANTERN:

HOW TO MAKE IT AND USE IT.

By A PRACTISED HAND.

I.—INTRODUCTION—THE LANTERN BODY—THE SLIDE-STAGE.

THE Magic Lantern is such a popular and useful instrument that I feel sure a series of papers on its construction and management will be acceptable to many of the readers of AMATEUR WORK.

Magic lanterns vary as much in price as most other optical instruments; the cheapest lantern, which is only suitable for amusing children, does not cost more than three or four shillings, while some of the best dissolving-view lanterns may cost, with the necessary accessories, as much as thirty pounds, or more. Between these extremes of price there are, of course, many excellent lanterns. The one that I am about to tell my readers how to make would cost, to buy new, between three and four pounds, but the sum it will cost to make at home is, of course, very much less, particularly if the amateur is a photographer, and has a portrait lens which he can adapt to it, as the objective and the condenser are the expensive parts of the instrument. It is a good, strong lantern, handy and portable, and for those who have had some practice in the "art"—if I may call it an art—of working in sheet metal, not difficult to make. Any kind of slide —photographic as well as coloured—may be shown in it, and it is well suited for exhibiting what are called "effects," some of which I will describe later on.

All magic lanterns may be said to consist of three parts : first, the body of the instrument ; second, the optical arrangement ; and, third, the source of light. We will begin with the lantern body, which in modern instruments is an oblong metal box for enclosing the light. It can be made of tin, "Russian iron," sheet brass, or other metal. When made of tin it is generally either cased with mahogany or "japanned." Casing it with mahogany makes it bulkier, heavier, and more costly, but adds greatly to its appearance. The disadvantage of japanning it is that the japan is very liable to crack and fall off, leaving, of course, the tin exposed in patches. "Russian iron" does not crack, or blister, or rust, but is rather difficult to cut and shape. The amateur had, therefore, better choose between brass and tin. Brass looks very well when nicely polished on the outside ; but if the lantern is made of it, it will have to be japanned inside, as the inner surface of body must be black, or at least dark.

The following tools will be required to begin with, and may be purchased anywhere for a few shillings: A boxwood mallet, such as is used by plumbers; a couple of hammers, of which one should be small, and

the other of medium size ; a punch for making rivet holes—a "French" nail is sometimes used for this purpose, but more than one will be needed, as the point soon gets turned, and the nail is then useless ; a pair of shears of suitable size, some files, pincers, a set-square, a two-foot rule, compasses ; a hatchet-stake or plumber's anvil—a large cold chisel with a rather sharp edge will do instead, but is not nearly so convenient ; a soldering "iron," and materials for soldering ; a few feet of binding wire, some copper tacks for rivets, and a piece of either tin or brass—whichever the amateur prefers to use—about a foot wide and some four feet long. These are the only materials we require at present. We can now begin.

The Lantern Body.—First cut out the following pieces, taking care to cut them straight, and without rough edges :—

A, a piece for the bottom of the body, $14\frac{3}{4}$ inches by $5\frac{5}{8}$ inches ; B, a piece for the sides and top, $19\frac{3}{4}$ inches by $8\frac{1}{2}$ inches. There must be an opening cut in the middle of this piece $6\frac{1}{2}$ inches long by $2\frac{1}{8}$ inch wide, as shown in Fig. 1, A, B, C, D. (These figures are drawn to a scale of 3 inches to 1 foot.) C, a piece rounded at one end to form a door, as in Fig. 2 $5\frac{1}{2}$ inches wide by $5\frac{1}{4}$ inches high ; D, a piece for the front of the lantern, of the same width as the bottom piece ($5\frac{5}{8}$ inches) and $13\frac{9}{16}$ inches long. It is rounded off at one end to match the top of the door, C. About $1\frac{3}{4}$ inches from the rounded end a circular opening must be cut in it for the condenser (see Fig. 3, A). The diameter of the aperture must be a good $4\frac{1}{8}$ inches (I am supposing that a 4 inch condenser is to be used. Smaller ones are sometimes recommended, because they are cheaper and lighter ; but the 4 inch is the standard size, and, therefore, the best). In this front piece the air-holes B, B, must also be made at from 3 inches to 5 inches from the straight end ; E, a strip for connecting the front, D, with the bottom, A, $17\frac{1}{16}$ inches by $1\frac{1}{16}$ inches, with two sets of air-holes (Fig. 4, A, B) ; F, G, two strips $5\frac{1}{2}$ inches by 1 inch ; H, one strip 14 inches by $1\frac{1}{4}$ inch ; I, one strip $14\frac{1}{2}$ inches by $1\frac{1}{2}$ inches ; J, K, two strips 8 inches by 4 inches ; L, M, two strips $13\frac{3}{4}$ inches by $1\frac{1}{4}$ inches ; N, one strip $4\frac{1}{2}$ inches by $\frac{3}{4}$ inch. These last three strips may be of tin, as they are fixed inside the lantern and are not seen.

The fourteen pieces being cut out, the next thing to do is to flatten them, if necessary, with the mallet, and to file off with a sharp file any roughness or inequality in the edges, after which the holes for the rivets must be made, the inside strips fixed in their places, the edges folded over or turned up, and the top-piece bent into shape. (See Fig. 5, which shows the lantern, as it will be when finished.) The letters correspond, but the drawing is not to scale.

Beginning with the bottom-piece, A, the four corners should first be snipped off, say about a quarter inch, then the edges must be turned up all round between $\frac{1}{8}$ inch and $\frac{1}{4}$ inch. The two $13\frac{3}{4}$ inch strips, L, M, are then to be fixed on to the bottom with four or more little rivets ; but, first, the outer edge of each strip must be turned up and over, so as to form a groove about a quarter inch deep, and about the same width on each side of the bottom-piece. The grooves are for the lamp to slide in. The distance between the grooves must, of course, be the same throughout ($4\frac{3}{4}$ inches). The other little tin strip, N, has one edge turned over and hammered down to form a smooth edge, and is fixed to one end of the bottom, between the two grooves. It can be fixed in its place either with solder or with rivets. The turned-up end of the bottom-piece being hammered down over it so as to grip the sharp edge, completes that part of the lantern. The riveting is best done with copper tacks, which should be cut in half, and the head end used. A hole being punched where the rivet is to be, the tack is inserted and the end hammered until a second head is formed.

Then cut the corners off the large piece, B, and turn up the edges all round, which is done by placing the piece on the hatchet-stake or cold chisel, and hammering it over it, so as to turn down a strip about a quarter inch wide. Some little practice will be required to make the edge even, which is absolutely necessary if the different pieces are to fit together nicely afterwards. The edges must be turned up the same way all round.

Hammer down the edges, E, A, B, F, Fig. 1, and make some slight cuts along the opposite edge, between G and H, so that the piece may be bent into the form of an arch, as shown in Figs. 5 and 6, where B, B, are the sides of the lantern (that is to say, the piece we are now at work upon) and I is the base of the chimney. Having bent the bridge into shape, place it on the bottom, A, and see how it fits ; but do not fasten it on yet, as the I piece has to be fitted into the aperture on top. First cut about three-quarters of an inch off the two opposite corners of the I piece, and fold over the edge along the side between the cut-off corners, then make the two cuts, A, B, Fig. 8, in the opposite edge about half an inch deep. The cuts are $5\frac{3}{8}$ inches from the end, and the distance between them $2\frac{1}{16}$ inches. Now bend the piece into shape, and spread out the lower edge between the cuts (see Fig. 7), put it into the chimney opening, with the turned up edge inside. It is, of course, to be riveted to the top of the lantern ; but before it is riveted, the J, K pieces are put into the lantern in the position shown in Fig. 6. The edges are slightly bent to make them fit. Rivet holes must be punched

through them, and through the spread out edge of the I piece, and through the top of the lantern, so that the one set of rivets may fix all the pieces in their place. The use of J, K pieces is to strengthen the top of the lantern; they are secured at the lower end with a couple more rivets.

The top of the lantern can now be fixed on to the bottom-piece. No rivets are required, the bridge-piece is put between the turned up edge of the bottom, and the edge is turned over and hammered down. A strong neat, light-tight joint is thus formed with very little trouble. Of course, the back of the bridge-piece must be in a line with the back edge of the bottom-piece.

We must now turn our attention to the front-piece, D, Fig. 3. If the air-holes mentioned before have not yet been made, they must be made now, then the two corners are to be cut off, and the edges turned down. The two little $5\frac{1}{2}$ inch strips, F and G, have one edge turned over and hammered down, and one corner rounded off; they must then be slightly grooved or bent lengthways and riveted on to the front-piece beside the air-holes, and parallel to the edge of it; they will thus form two grooves $4\frac{1}{4}$ inches apart (see Fig. 3, F, G), extending from about half an inch from the end of the front to near the middle.

The next thing to do is to form the cell or receptacle for the condenser. This is done by fixing the H strip over the circular opening, A. We first of all bend over an edge at each end of the strip; one edge should be about one-eighth of an inch, the other about a quarter of an inch, then, placing the two ends together to form a ring, the $\frac{1}{4}$ inch edge is to be turned over the $\frac{1}{8}$ inch edge, and the two are then to be turned down and flattened with a hammer. By this means solder is avoided, but, of course, if brass is used, and the amateur knows how to "solder" it, it would be as well to do so. The strip must then be $\frac{3}{8}$ inch shorter, as the ends being placed together nothing is to be allowed for turning over. The diameter of the ring should be such that it will fit tightly into the opening, A. Having tried it, and found that it fits, we make cuts of equal lengths (about quarter inch), and at equal distances apart along one edge, and turn out the pieces between the cuts so as to form a flange. We then fix it in its place by means of rivets, as shown in Fig. 5; the cut edges of the flange will not be seen, as they are inside the lantern; the cell projects about an inch from the front; the outer edge should be *slightly* hammered inwards, so that the condenser may be held in its place.

We must next fix the E strip on to the projecting end of the bottom-piece. Having made the air-holes, A, B, Fig. 4, we turn up both edges and bend the strip

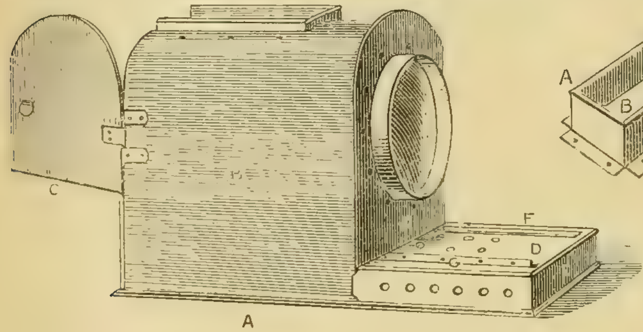


FIG. 5.—PERSPECTIVE VIEW OF LANTERN WHEN FINISHED.

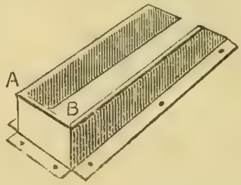


FIG. 7.—TOP OF LANTERN (I PIECE).

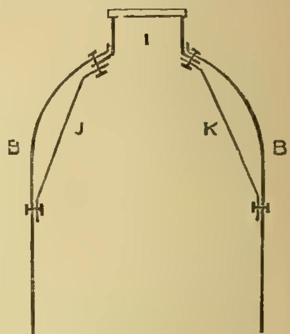


FIG. 6.—TRANSVERSE SECTION OF BODY OF LANTERN.

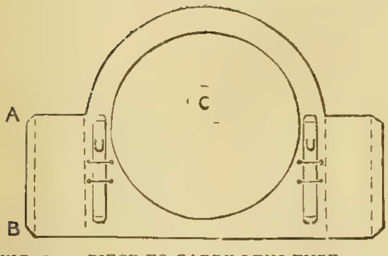


FIG. 10.—PIECE TO CARRY LENS TUBE (T-PIECE).

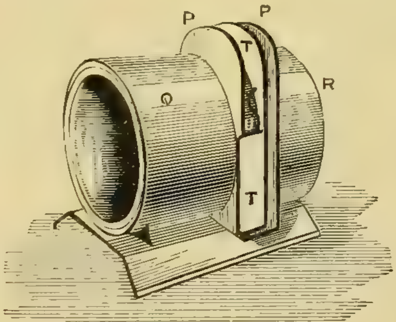


FIG. 9.—SLIDE STAGE AND LENS TUBE—PERSPECTIVE VIEW.

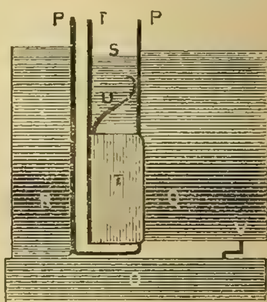


FIG. 8.—SLIDE STAGE AND LENS TUBE—SIDE VIEW.

into shape, first making a cut in the turned up edge at C, D, E, F, where the bends are to be. The four end corners must be cut out as shown. The best way to make sure of bending it right is to take the centre, and measure from it $2\frac{7}{16}$ inches, or somewhat less than down, and hammer together to form a smooth joint. Then turn over the edge of the bottom-piece on to the edge of the strip, and hammer it down; do the same with the edge of the front-piece to fasten it to the bridge, and the lantern body will be so far finished.

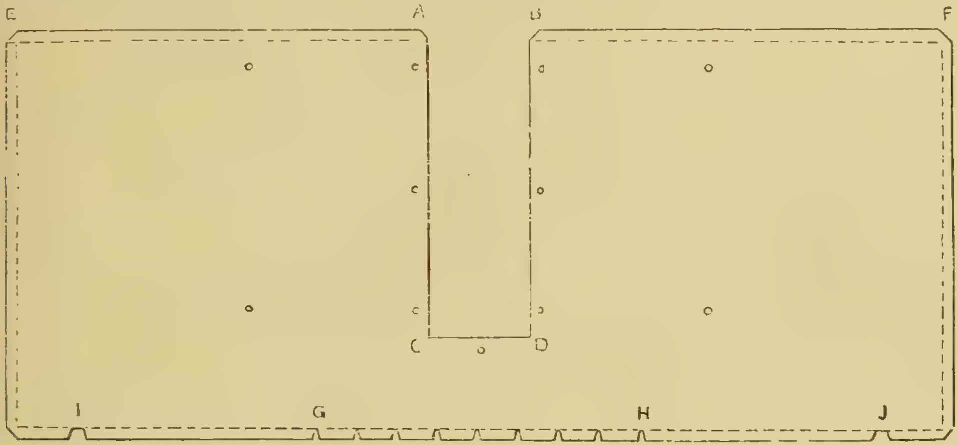


FIG. 1.—PIECE FOR SIDES AND TOP OF LANTERN (B PIECE IN TEXT). Scale, $\frac{1}{4}$ inch to 1 inch.

$2\frac{1}{2}$ inches each way, make the cuts there, and bend the two ends towards each other until they are parallel. Now fix it on to the end of the *front*-piece by turning over the edge of the latter and hammering it down, just as we did with the side-piece, B. Bend the front-piece at right angles at a distance of $6\frac{1}{8}$ inches from the turned up end, or rather, to make In hammering down the edge of the front-piece, a hammer or mallet must be held against the opposite side so as to have something to hammer against.

We will now fasten on the door, Fig. 2. First turn up the edge about a quarter of an inch, as shown by the dotted lines, then put it into its place at the back of the lantern to see how it fits. It should go over the

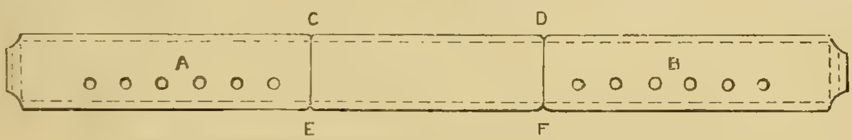


FIG. 4—STRIP FOR CONNECTING FRONT AND BOTTOM (E PIECE).

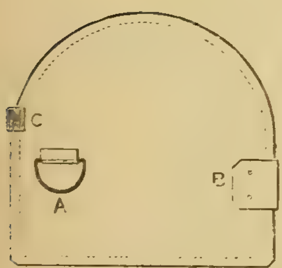


FIG. 2.—PIECE FOR DOOR (C PIECE). Scale, $\frac{1}{4}$ in. to 1 in.

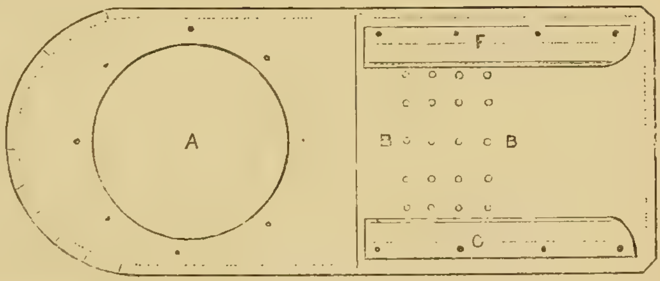


FIG. 3.—PIECE FOR FRONT OF LANTERN (D PIECE).

sure that you bend it in the right place, lay it beside the lantern, which will show you exactly where the bend should be. All that is now to be done is to cut out a little piece at each side of the B piece, where the strip meets it, as at I, J, Fig. 1. Put the strip and front in position, turn the ends of the strip over the edge of the B piece, from the cuts, bend the two ends edge of the back easily, but not too loosely. A 1 inch brass ring, A, Fig. 2, or a brass knob, is next to be fitted on to one side to serve as a handle. If a ring is used, the best way of fixing it on is to make a slit in the door, flatten a part of the ring, put a strip of metal over the flat part, slip the ends of the strip through the slit, and separate them on the other side of the

door; they may then be soldered or riveted down. The brass knob is usually fixed with a nut. A catch, C, is also advisable, to keep the door shut. A strip of metal inserted in a slit in the turned up edge of the door, and soldered or riveted on to it, is bent to form a hook, which is made to catch in a little wedge soldered on to the side of the lantern. To make the hinge, take a piece of brass or other metal about two inches long, and bend it round a piece of wire or a French nail of medium size; this is done by hammering the edge down over it until a little tube is formed, which is soldered and cut into three pieces, of which one may be 1 inch wide, and the others ½ an inch each. File the edges quite smooth, and fix the inch piece on to the door, and the other pieces to the lantern, so that the edge of each is in line, one of the ½ inch pieces being above, and the other below the piece affixed to the door. A piece of wire of the right thickness run into the three tubes and the ends bent or hammered over to prevent it falling out, completes the hinge, B, Fig. 2. (See also Fig. 5.)

In this lantern the lower half of the back is open to admit a free current of air, as well as to allow of the wicks of the lamp being regulated without opening the door. All who have sat near the lantern at an illustrated lecture, either in a public hall or in a private room, know what a nuisance the frequent opening of the lantern door is, and will realise what an advantage it is not to have to open it so long as the lantern is in use.

We now come to the slide-stage and lens-tubes, which, in the old form of lantern, were fixed to the front of the instrument by means of thumb-screws, but which, in lanterns of the new form, such as I have been describing, are separate from it. They are now fitted on to a sort of metal bridge or stand, which slides into the grooves, F, G, Fig. 5, and may be placed nearer to or further from the front of the lantern, as is found most convenient. The advantage of the present arrangement is, that the slides are more easily changed; it is better adapted for certain "effect scenes," and it is lighter and simpler. When the slide-stage and lens-tubes are fitted on to the front of the lantern, the lantern itself must be stronger, and even then there is always a chance of its being strained, especially when lengthening tubes are used, as must sometimes be done in very large halls.

This part of the lantern is almost always made of sheet brass. It may be of the same thickness as that used for the body. First cut out a piece $5\frac{3}{4}$ inches by $5\frac{3}{8}$ inches, this will form the stand or bridge, O, Figs. 8 and 9. A $\frac{1}{8}$ inch edge is turned down all round, and the bridge bent into shape. The sides are $1\frac{1}{8}$ inch wide after the edge is turned over, and the bridge stands nearly one inch above the grooves when properly bent. It must, of course, be tried in the grooves, and the bend altered, if necessary, until it runs freely in them.

The slide-stage is formed out of a piece $11\frac{1}{2}$ inches long by $5\frac{1}{8}$ inches wide, bent as shown at P, P, Figs. 8 and 9. But before bending it, the two ends must be rounded off, the edges turned over in the usual way, with cuts where the bends will be, and two circular openings cut out, each $3\frac{5}{8}$ inches in diameter.

We next turn our attention to the tubes, Q, R. The tube, Q, is $3\frac{15}{16}$ inches in diameter and $2\frac{3}{8}$ inches long; the other tube R, $4\frac{3}{8}$ inch in diameter and $1\frac{5}{8}$ inch long. The former is made of a strip of metal $12\frac{5}{8}$ inches long, and the latter of a strip $14\frac{3}{16}$ inches long. Begin by filing the ends quite smooth and level; then bend the strips into tubes, or if you have a cylinder or disc of the right diameter, you will find it a good plan to fold the strip, as it were, round it, taking care that the ends meet exactly. Secure it in position with wire wound three or four times tightly round it, then remove the disc or cylinder, and join the ends with solder. Remember that the great secret in making a strong, neat joint with solder is to have the ends to be united perfectly clean and bright, and to use the smallest amount of solder possible. "The less the solder, the stronger the joint," should be the amateur sheet-metal worker's motto. Brass work is often joined by brazing, and the *modus operandi* is as follows: First file the edges and about the eighth of an inch of the inside edge of the metal strip until a narrow band of bright metal is obtained, then bend the strip as before described, and fasten it together with iron wire. Mix some borax into a paste with water, spread it along the line where the joint is to be, put some granules of spelter here and there with the borax paste, and heat the tube gradually over a clear, bright fire until the spelter melts. Make sure that the spelter runs into the seam by swaying or jerking the tube just as the spelter melts, and when the tube is cold it will be found to be so strongly and neatly joined, that the seam itself is scarcely to be distinguished from the surrounding metal. The tubes may now be fastened on to the slide-stage piece over the openings. If they are not perfectly cylindrical, or if there are dents in them, they must first be pressed into shape, and the dents carefully hammered out. When they have been placed exactly in position, one over each aperture, and both on the same side of the stage-piece, drop a few drops of solder along the edge to keep them in their place while you are soldering them on.

Two more pieces, S, T, must now be cut out. The first is a strip 12 inches by $1\frac{1}{2}$ inches, bent into a ring or tube, which will slide easily in the tube, Q. The second piece is $7\frac{1}{2}$ in. by 5 in. One side is rounded

to correspond with the top of the slide-stage, the other side is cut into the shape shown in Fig. 10, the length of the flaps is $1\frac{1}{4}$ inch, width (from A to B) $2\frac{1}{4}$ inches. The circular opening, C, is cut out in the centre of the piece, and the tube, S, soldered round it. The little bow-shaped springs, U, U, are then fastened on to it, between the tube and the flaps, the tube, S, is put into the tube, Q, the flaps are turned down, and about a quarter of an inch of the end of the flaps is turned over the front of the slide-stage, to prevent the springs from pushing the piece out of its place. The object of this spring-piece is to keep the slide-holder (to be described later on) pressed against the other side of the stage.

Two little pieces of a clock spring about a quarter of an inch wide will do for the springs, and they may be fastened in their places either with a couple of wires passing through holes in the T piece, and twisted over them, or with a strip of tin or brass soldered over each to form a band. The ends of the springs, if not turned up, must be "tipped" with a little bit of brass in order to prevent them from catching in the side of the stage. The diameter of the aperture, C, should be somewhat less than that of the tube, S. The last thing to be done is to bend the slide-stage piece into shape (the space between the sides being $1\frac{1}{8}$ inch) and solder it and the tube, R, on to the bridge, O. The other tube, A, must have a support under it, V. This support must be cut out to let the tube lie in it. It is then soldered on to the bridge-piece, and the tube soldered on to it. Our lantern body is now finished, but if made of brass or tin, it, as well as the lens-tubes. must be japanned inside.

The chimney forms part of the lamp, and will be described with it in the next paper.

(*To be continued.*)

PRACTICAL SCENE-PAINTING FOR AMATEURS.

By HENRY L. BENWELL.

(*For Figs.* 90, 91, *and* 92, *see Folding Sheet issued with this Part.*)

XIX.—Transformation Scenery continued—General Accessories—Description of the Drawings and Directions for Painting the Scene—How to Set and Work the Transformations.

SET pieces for transformation scenes are often very numerous: sometimes as many as eighty or ninety pieces are used in the building up of a single scene. The artist should in all cases make a working model of the scene with all its set pieces. This is placed on a miniature stage, and is handed to the head carpenter, who makes all the *framework* from it to scale. The edges of all wings should be of profile. The rapid changes which take place, transforming one scene into another, are all designed by the artist. These changes are often very numerous. Amongst the devices employed for effecting these changes the principal are the following :—

At every change that takes place in a *transformation* some new subject is produced: wings glide off imperceptibly and discover others; set piece after set piece changes, some by sinking or gliding away, others without moving, by means of Scruto.

Some scenes consist of "rise and sinks," one half the scene ascending into the flies and the other sinking through the stage. Fan pieces are made on the principle of the fan, opening and dividing from the centre. They are often used for discovering a group of fairies, as will be presently shown. In this way also flowers open and discover fairy children in various attitudes.

After the painting of a transformation is completed it is worked up with foil and metal, so we cannot do better than give a general idea of the various processes employed in this branch of the art.

For securing the effects of the high lights, which are usually painted in carefully, and depend upon the general character of work for their brilliancy and effect, extensive use is made of Dutch metals and foils of different colours and shades. There are two sorts of Dutch metal—yellow and white, commonly called gold and silver. The metal is put on to the canvas with a preparation known as *medong*. It is used from a medong pot, which is similar to a glue pot, one case fitting into the other, with a spirit lamp under the inner case. This is necessary, as the medong can only be put on very hot. A long camel hair brush is used, but the metal need not be put on until the day following this dressing, as it will remain "tacky" for several days afterwards. When, however, it is applied, it is pressed on, and afterwards carefully

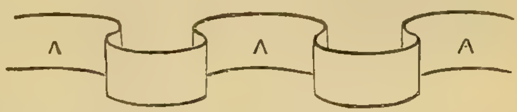


FIG. 100.—METHOD OF FIXING FOIL TO CANVAS.

brushed over with a piece of cotton wool. The following is a receipt for making medong :—

"Take equal parts of pitch, Venice turpentine, resin, beeswax, and Russian tallow; put them into the medong pot and melt them together; but should the mixture work too thick and stiff, add more wax and tallow. The more tallow that is added to the mixture, the more pleasantly it will work; but if too

much is added it will never harden, so care must be taken not to overdo it. The resin and pitch form the hardening part of the mixture. In hot weather it can be used much harder than in cold, as the heat keeps it *tacky*, which is required to make the Dutch metal adhere to it.

Foil Paper is made in every shade of colour, and sold in sheets at 6d. and 8d. each. In foiling a scene care must be taken not to put the foil on flat, as by so doing the same quantity of light is not caught, and, consequently, a loss of the greater part of the brilliancy and glitter on which the general effect depends. In order, therefore, to make the foils stand out from the canvas, so as to catch the light, some cotton wool may first be glued lightly on the scene, and the foil afterwards lightly laid on with some glue paste. Another plan is to let parts of the foil stick up or away from the canvas, as shown in Fig. 100, A, A, A, being the only parts that are attached to the canvas.

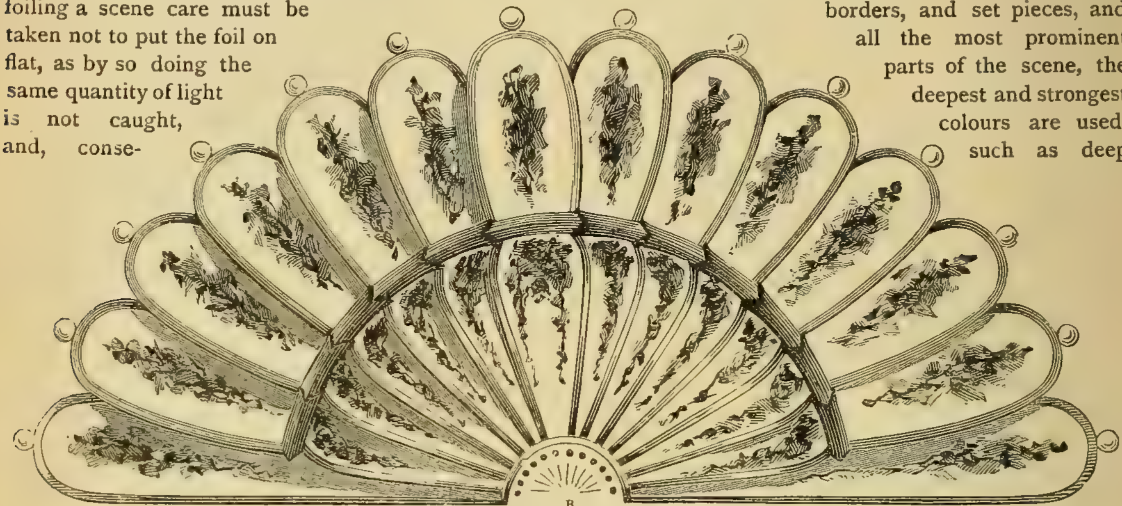


FIG. 95—CENTRAL FAN PIECE.

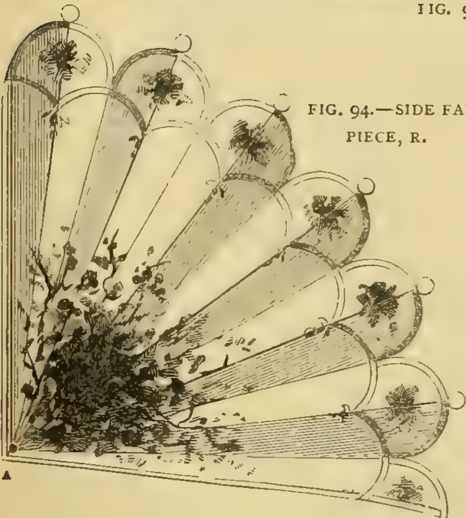
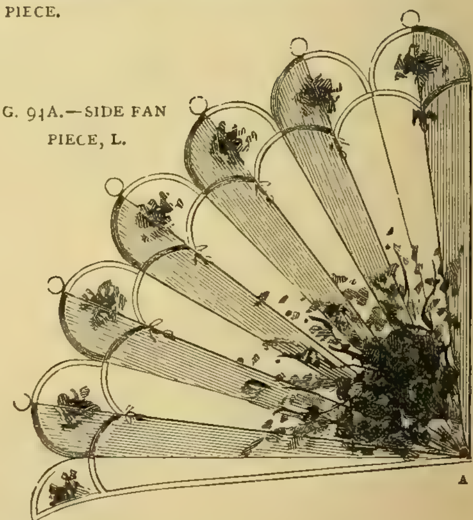


FIG. 94.—SIDE FAN PIECE, R.

For Positions, see Scene Plot in Fig. 100.



[FIG. 94A.—SIDE FAN PIECE, L.

A rich and sparkling effect is thus obtained. Even when putting on straight strips of foil it is much the best plan to crinkle the paper, so that the light may catch it at all angles and so be reflected to the eye of the spectator in any part of the house. As previously mentioned, foil paper is made in all colours and in various shades of each colour, and they are used by the artist as follows: For the first wings, borders, and set pieces, and all the most prominent parts of the scene, the deepest and strongest colours are used, such as deep gold, crimson, purple, or blue. On the second wings, etc., a shade lighter is used, and so on, till the extreme distance is reached, where the lightest pink, blue, green, and canary colour may be used. In this way a splendid aërial effect, and a greater variety of colour, is obtained. Great care should be taken to cut out the strips of foil paper exactly, so as to fit the required shapes on the canvas where it is to be used.

For painting the inside of shells, which open and

FIG. 90.—"BEE" GAUZE.

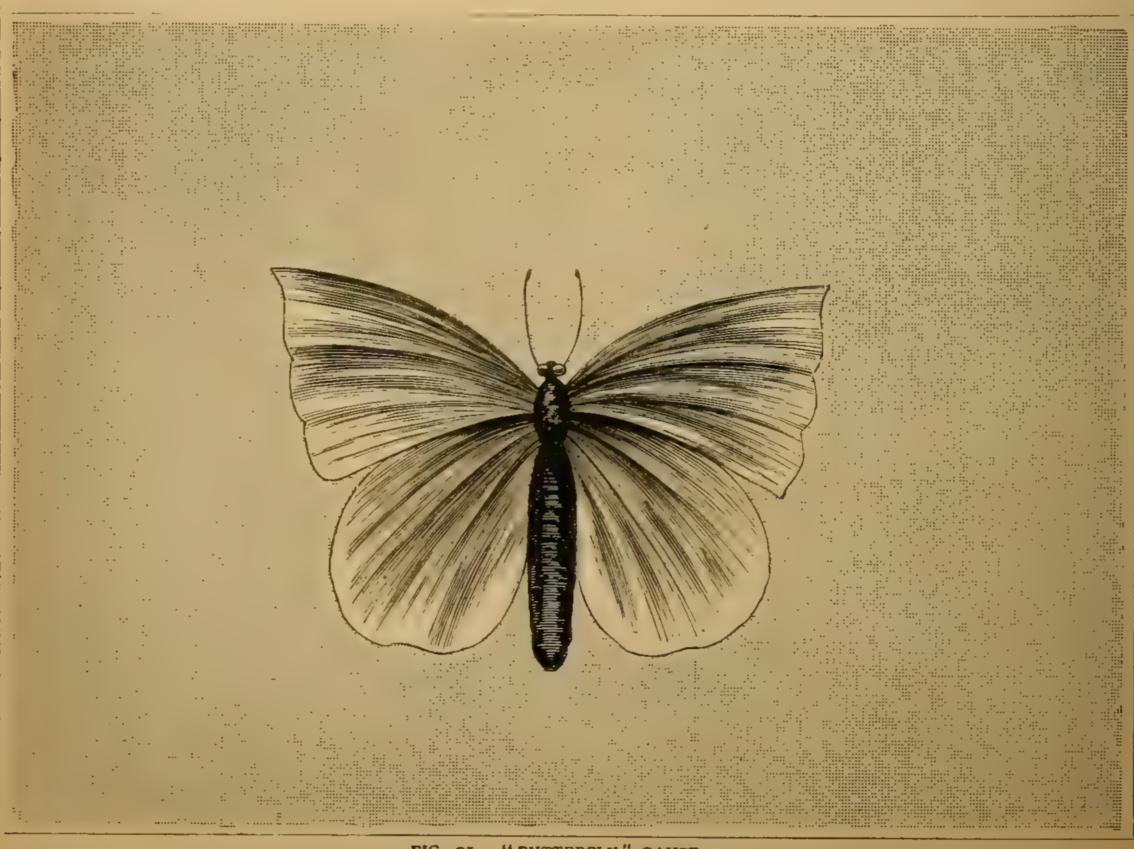


FIG. 91.—"BUTTERFLY" GAUZE.

FIG. 92.—THE TRANSFORMATION SCENE FULLY DEVELOPED.

FIG. 98.—SPECIMEN BORDER.

discover cupids or fairies, large quantities of matt gold and silver paper are used. These sheets are first pasted down to the property shell, and when dry are stained with a variety of transparent oil colours, such as green, crimson, or blue. Delicate prismatic colours have a very charming effect. The oil colours used for this purpose are those that are made up in tubes for coach-painters, and should be mixed with a little varnish and terebine. Coral borders can be cut out of stiff millboard and strengthened at the back

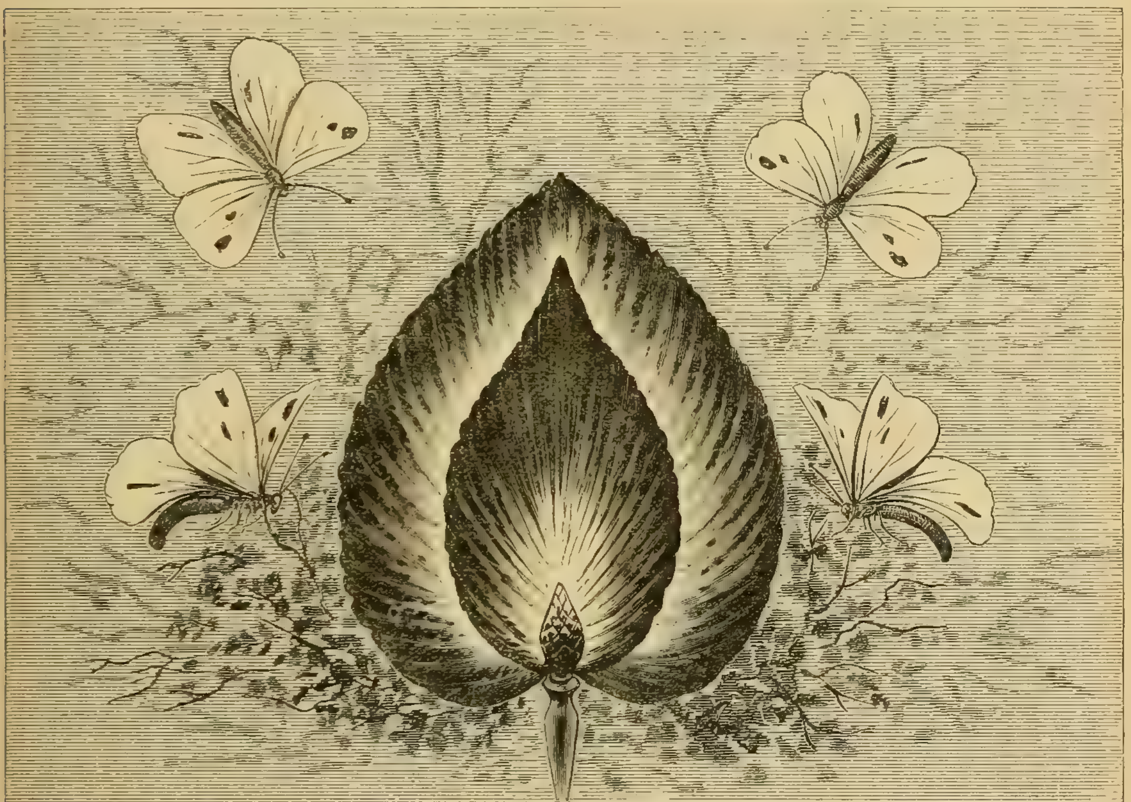


FIG. 93.—BACK CLOTH.

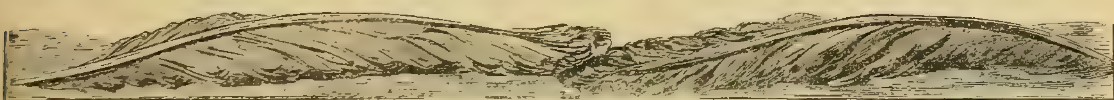


FIG. 96.—FIRST GROUND ROW.

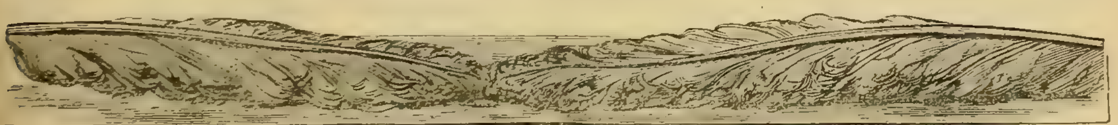


FIG. 97.—SECOND GROUND ROW.

with wood battens or wire. They then receive a priming of size, and are afterwards painted in with *flatting*, *i.e.*, colours *thinned out* with turpentine and patent dryers or japan gold size. The best colours to use for painting coral are pink, white, violet, orange, and crimson. Strips of foil paper are afterwards pasted on between the forks and stems, leaving a little colour on each side. The reader must not forget, however, to crinkle the foil as before advised. *Ossidue*, and *gold*, and *silver tissue*, are also used by the artist for these fairy scenes, and has a bright and beautiful effect.

Logies are zinc ornaments stuck on to scenes to represent jewels, etc. Later on, a description of how they are made will be given. They are fixed on to the canvas with a preparation of whiting, turpentine of Venice, and glue, used very hot; but where possible, they are nailed into the wooden framework of the "flats." The above "compo" is rubbed over the back of the ornaments with a piece of stout cardboard or wood, and the "logie" gently but firmly pressed down on to the canvas and the hand afterwards slowly withdrawn.

Spangles are largely used for transformation scenes. They are flattened discs with a hole in the centre, and can be had in all colours. With the help of these some very pretty effects (to be described later on) can be obtained, such as a drooping well, a grotto, or the rocks beneath the sea. For this they should be hung on fine wire or string from the borders and wings, and placed about the scene according to taste.

Bronze Powders have occasionally been made use of by some artists. They are metallic powders of gold, silver, bronze, steel blue, red, purple, and other shades. A brush full of glue is lightly drawn across the required surface, and the bronze is carefully dusted over it. The consequent appearance is that of a rough metallic surface similar to that of frosted silver.

Frosting, which gives a sparkling or crystallized appearance to snow and other scenes, is merely crushed or powdered glass. It is made to adhere to the canvas in the same way as the bronze powders. It may, perhaps, here be necessary to caution the novice as to the dangerous character of bronze powder and *frosting* when inhaled into the lungs: nothing can be more injurious, and it is recommended that a woollen scarf or cravat be tied round the mouth when these articles are being applied. Let the reader not forget should there ever be any occasion to make use of them.

Ribbons of various colours, thickly spangled, and cut into *various* lengths, are often made to descend from above, row after row, till the whole of the top portion of the stage is covered with the glittering ribbons, thus producing great scenic effect. A good many of the effects used in producing a *transformation* have now been mentioned, space forbidding us to carry the reader any farther into the depths of "fairyland."

The last thing that the scene-painter does before the production of the pantomime, is to have his scene set upon the stage at night, in order that he may arrange the lighting. The "gas man" of the theatre is the artist's mainstay, for it lies in his power to ruin the finest scene that was ever painted. The proper lighting of a scene is therefore a matter that requires the most careful study. The artist should sit in the centre of the auditorium and minutely observe every nook and corner of his scene under the glare of the gas. Here a light is turned up, and there one is lowered, until the proper effect is secured. The gas man takes careful note of his directions, and the stage manager oversees all.

Following this the lime-light effects are tested and rehearsed, and, lastly, the coloured fires are brought into play, and the quantity ascertained (by weight) for nightly use. Long after the audience have left the theatre on the nights previous to the production of a pantomime, the stage hands, the artist, and the stage manager, are hard at work, and the public sees only the charming result of their labours when the curtain rises for the first time on Boxing Night.

The Working Drawings, and how to Paint the Scenes from them.—Let us now consider as briefly as possible, how we can best colour and "work up" the simple subject—for simple it is and was intended to be—which illustrates these pages.

Proscenium Wings.—These wings (Figs. 87, 87A, p. 24) are laid in with a mixture of Venetian red, black, and white. For the drapery use Prussian blue in different shades, and flake white for cutting up. Mouldings as previously described.

Subject Wings.—Three pairs of these will be required, of which the first pair is shown at p. 25, Figs. 88, 88A. They are all of the same design, but the framework should in each case increase in width somewhat as the back of the stage is reached. As to colouring: Lay in the ground at top with a pale azure blue, when reaching about half-way down gradually blend into a pale yellow composed of Dutch pink and whiting; then on nearing the bottom of the wing, graduate into a somewhat richer blue of indigo and whiting. This is merely the laying in of the ground. The two ornaments on stalks are supposed to represent some Japanese feather fans. Commence to paint them by glazing on thinly some pure carnation paste, adding more strength afterwards for second shadows. For the very deepest touches round the outside edges, mix a little brown lake with the

carnation paste The stems are laid in with raw sienna, and shaded up with burnt sienna and vandyke. Lay the straggling foliage in with light Brunswick green, and the shadows, indigo and Dutch pink. For high lights use chrome.

We next give attention to the Butterfly, and commence on his wings. These are white, with a light touch of azure blue, Venetian red, and a little yellow ochre. For the body of shadow use very thin and light indigo, and for the deepest shadows, umber and vandyke. The high lights of wings are touched on with pure flake white. All these colours must be laid on exceedingly thin, in order to obtain the necessary transparent effect. Mark up the veins in wings with vandyke and red umber. The body is laid in with pure azure blue and shaded with thin indigo. For the deepest shadows use vandyke brown. Legs and feelers, burnt sienna or strong lake.

First or "Fan" Cloth (Fig. 86, p. 24) is prepared as follows :—

Lay in the upper half of cloth with azure blue, and the lower portion with indigo and white (mixed). Let the two meet in the middle and graduate into each other. Next draw in your fan and mix the following *pot* colours : 1, a warm black with no white, composed of black and rose pink, or brown lake ; 2, a light blue black composed of black, whiting, and celestial, or azure blue ; 3, light gold colour, lemon chrome, and whiting with a little orange chrome ; 4, deep gold, orange chrome ; 5, glazing of pure raw sienna in strong size. For the light half, of each leaf in the fan, use No. 2 ; for the shadow half use No. 1. The outer rim of top circle is treated in the same way. The inner part of the circle is halved with light and deep gold colours (Nos. 3 and 4), as is also the zigzag band just below and the ornamental work at foot, the whole of the shadow parts being afterwards glazed over with No. 5. The ornaments in the circles are light and dark greys on the light and dark golds respectively, and the floral design at each bottom corner is worked in with some pale chrome. This is the first scene, and is therefore somewhat sombre and dull in its painting, in order to increase the brilliancy of succeeding scenes by excessive contrasts.

First or "Bee" Gauze.—The bee is painted on canvas stretched on a frame, and afterwards cut out the shape of the bee and glued on to blue net or gauze. There is a decided difference between net and gauze. Both articles are supplied by Messrs. Burnett, whose address will be found in an earlier chapter. Samples may be obtained. The wings : Glaze on a light grey shadow and leave the priming for lights. For the deep shadows use a deeper grey, and "mark up" with umber or vandyke. The body : Lay in the dark portion of body with vandyke and burnt sienna, light. For deeper shadows pure vandyke, and for the darkest touches of all, brown lake and vandyke. Bands on the body : Lay in with raw sienna and shade with burnt sienna and vandyke. The high lights, which are very small, are lightly brushed on with lemon chrome and flake white. The wings must be as transparent as possible, which is obtained by judicious glazing. (See Fig. 90, Folding Sheet.)

Second or "Kingfisher" Cloth.—Lay in with some azure blue a shade paler than last cloth, and blend off darker towards bottom with indigo or Prussian blue, not too deep or strong. Creeping foliage in background put in with indigo and ultramarine. The light side of the fan is the priming left, the shadow side of the leaves being a light thin grey composed of azure blue, Venetian red, and yellow ochre ; the blue, however, predominates, and the whole kept delicate in shade. Touch up with some flake white the light half of leaves where it meets the shadow. This is the white—laid over the priming that has been left—in the centre of each leaf, or along the edge of the shadows. The deep gold colour on shadow side of fan is brown ochre, *pure*, and the pale gold on light of leaves in lemon chrome and white. Bird : wings and back a pale Prussian blue, and just sufficient emerald green worked in to give a green tinge to the blue. First shadow, pure Prussian blue ; second or deep shadow, Prussian blue and brown lake, to give a deep purple tone. This work is pure glazing all through. All colours are used thin and *no whiting* mixed with them ; hence all the colours are transparent as in water-colour work, and are used one on the other to get the different effects. The white part of throat is the priming left or flake white. The breast is laid in with yellow ochre and burnt sienna, and shaded with burnt sienna and vandyke. The legs are pure vermilion and shaded down with a little brown lake. The beak is laid in lightly with vandyke and burnt sienna, a little vermilion being glazed down the opening or centre. Shade beak with pure vandyke. The eye is touched in with burnt sienna and shaded with vandyke. White light in eye is the priming left and touched over flake white. The foliage on fan is executed with same colour as given for the subject wings. (See Fig. 89, page 25.)

Second or "Butterfly" Gauze.—The body is put in with a pure, light Prussian blue. For first shadow the same colour of deeper shade. Second shadow, brown lake and vandyke. The feelers paint a pure vandyke. The small high lights of wings is the priming left, lay on first shadow with some very *thin* and *pale* Prussian blue, using the same a little stronger for second shadows. "Mark up" with some strong size, and a little indigo and

brown lake (mixed) very lightly touched on. The lights may be faintly toned over with a pale pinkish lavender tint, made with a dash of crimson lake and azure blue in some weak size. This must, however, be put on before the shadows, in order to keep the latter sharp and clear. The Butterfly is painted on a portable frame, the same as described for "Bee," and is also cut to shape and glued on to the gauze. These two subjects are on the scene itself, of "Mammoth" size, as will be readily understood from the designs. (See Fig. 91, Folding Sheet.)

Back Cloth.—The background of this cloth must be carefully laid in and graduated. To do so, proceed carefully to lay in at top a still paler azure blue. Continue this till about one-third of the cloth is covered, then blend in the pale yellow tint composed of Dutch pink and white, which, a little lower down, breaks into a pale vermilion (vermilion and white), and lastly, a faint grey rising from the bottom of cloth, blends gently into the vermilion. All the foregoing tints should be of the most delicate shade it is possible to obtain ; that is when they are viewed from a distance, such as in the auditorium, and, more important still, by gaslight. In the centre of this cloth is painted a large "feather fan," or hand-screen, as they are sometimes called. This forms a background for the group of figures. It is painted with pure carnation paste, the priming being the high lights. Next comes some thin carnation, and then for second shadows a deeper shade still ; and, lastly, all the strong parts are touched up with burnt lake and carnation paste. A little flake white may be introduced into the high lights. The stem is chrome, shaded with burnt sienna ; but this need not be put in, as the figures would hide it on the stage.

The butterfly and foliage is treated the same as those previously described for the subject wings, all the colours being used somewhat fainter for the back cloth. (See Fig. 93)

Mechanical Side Fans.—Draw in some bold lines down the centre of each leaf, and fainter lines to separate each leaf or flap of fan ; the fan is then painted the same as the large one described with "Kingfisher" cloth. Next lay in distant foliage with a light grey composed of ultramarine and Venetian red, follow on with a purple tone (ultramarine and brown lake) to give a roundness to foliage, and finish painting to match foliage on subject wings. For the branches or stems use vandyke and burnt lake, and pure carnation paste for the flowers. (See Figs. 94 and 94A.)

Mechanical Centre Piece.—This fan is made of profile, and each leaf is prepared and painted separately. The half circle at the bottom is of stout elm, and a similar piece at the back forms a groove, in which all the leaves or flaps of the fan fit, and a bolt running through the whole forms a pivot on which the fan is worked. The fan opens in the centre and falls to stage each side. The leaves are connected together with *webbing* tacked on at back, and so the set-piece works on the same principle as an ordinary fan. Lower the fan by long iron rods with hooks at one end and attached to each half of fan with two staples or screw-eyes. They are held in place by stage screws till the fan is worked. Paint round the edges of each leaf with the light gold colour ; the shadow part in centre of leaf is the deep gold and burnt sienna. The whole of the floral ornaments treat the same as on side-pieces. The leaves may either be left white, *i.e.*, priming, or may be laid in with flake white, and again a ground of a very pale lavender tint may be used. Instructions how to work the fan is given later on, and a working drawing may be given in papers on carpentry as to making it in one or two different ways. (See Fig. 95.)

The Ground Rows, shown in Figs. 96 and 97, are two large crimson feathers laid on a light and dark blue ground. They are painted with the same colours and in the same way as the large feather fan on back cloth. They are made of profile.

The Borders (Fig. 98) are laid in with the azure blue, and the foliage treated similar to that on subject wings. The dragon flies on each side have their wings painted about the same as those of the bee, whilst the body is done in three shades of Prussian blue.

How to Arrange the Scene on the Stage.—Behind the proscenium wings is hung the first cloth. Immediately behind this, but so as to clear, comes first ground row ; then follows first gauze, first subject wings, and behind wings second ground row. To clear ground row hang second cloth, and between first and second wings comes the Butterfly gauze. Next, the third ground row, if one is required, and then close up comes the second wings. The side fan pieces come close up behind these wings, and have a bolt at the bottom outside corner, which runs through the framework at the bottom inside corner of the wings, and A forms a pivot for the pieces to work on. Behind these fans are the slanting padded banks for the fairy figures to recline on. Next comes the third pair of wings, followed by the centre fan immediately behind whilst the centre bank sits between the fan and the backcloth. From four to five borders (Fig. 98) will be required, and these are allowed to hang just below the wings. The first border hangs between proscenium wings and first cloth. The arrangement of the scene may be best understood by reference to Fig. 99, which explains itself. This is known, technically, as a "scene-plot," and it is necessary to have one of these well drawn

for the stage man, as this is his guide for setting the scene properly on the stage in the absence of any model.

How to Work the Scene effectively.—This transformation scene is, of course, only intended for a small and temporary stage, as it would be utter waste of time to describe the more elaborate affairs, as seen in our large theatres. But still, by various devices and dodges the amateur stage-manager may utilize, or rather imitate, some of the effects that are only produced by means of great expense and much machinery on the larger stage. Thus we will disclose a few secrets as we proceed.

The best way to work the lime-light on a portable

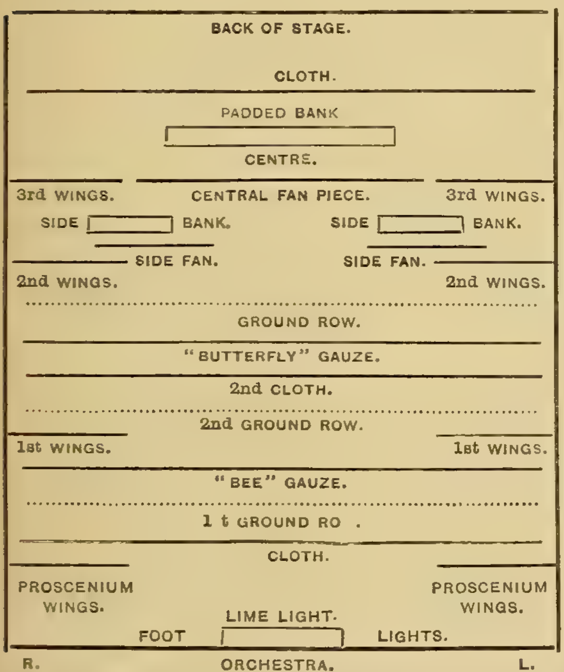


FIG. 99.—SCENE PLO OR GROUND PLAN OF TRANSFORMATION.

stage is to have a little cabin or box, which is entered by the attendant from beneath the platform or stage. The reflector, or lamp which holds the light, stands about one foot above the stage, and arranged to throw a diffused light over each scene. Better still, however, the light may be worked from behind on temporary "flies," such as a plank on builder's high tressels or two pair of steps.

The transformation now commences, all lights are down and are slowly rising; next the first cloth is slowly ascending, the band all the while discoursing some dreamful strains. The first gauze is now disclosed, and on the lights getting brighter a gigantic bumble bee is discovered, as it seems to be in mid air. "Look," say the little ones; the bee takes flight and disappears into the blissful realms above, but only to disclose something more beautiful in its place—the kingfisher on an enormous fan. Now the lime-light comes in, and red, violet, and orange mediums, are thrown on to the scene; now the light disappears, and slowly—for all is done deliberately and not too quick—the scene either ascends above, or sinking through the stage, disclosing the "Butterfly" gauze. All lights behind this gauze, be it remembered, are still down: they now begin to rise, and give faint glimpses of more rapturous realms beyond. Now the butterfly takes it in his head to fly away, and the fans consequently come into view. After throwing one or two tinted mediums on to them, the naked lime-light is now let loose, and the side fans commence to turn up behind the second pair of wings, and disclosing fairies reclining on banks covered with gold cloth. These fans are merely pulled over by hand, the wing hiding completely the stage men. The side fans now disclose into full view the centre fan, the music at this moment increasing in strength and brilliancy of fancy. Now the centre of fan slowly opens (the limelight full on) and falls each way to the ground, and discloses the rest of the figures on a padded bank at centre. This is the last movement; the coloured fires are now ignited, the music reaches its highest pitch, and the picture is gradually closed in with the first scene of the harlequinade.

All the gauzes and cloths should be made to roll up on box rollers, and worked with an endless cord, on the window blind principle. Should the Kingfisher cloth be made to sink down instead of ascending, a lath of strong profile should be at top, with its edge cut to match the foliage. A cord is attached at each side and run over pulleys, the cloth being gradually lowered behind a ground row, and allowed to fall in folds on to the stage. This has the effect of the scene sinking through the "cuts" on an ordinary stage. When done with it should be put on a roller until required for the next night. Indeed, they can be made to work on rollers from the bottom, of which more hereafter. Fig. 92 in the Folding Sheet, shows the scene when it is fully developed, with the figures in their proper places and positions. The colouring of the back cloth will be noted here as being shown more vividly. It will also be noticed that the side fans are left projecting a little beyond the wings after being drawn back. The centre fan, when it has fallen, forms a ground row in itself. The scene has to be foiled, and other effects added to it, all of which have been previously mentioned, and no more need be said than that the title of this transformation is "A FLIGHT OF FANCY."

(To be continued.)

SMITHING AND FORGING.

By GEORGE EDWINSON.

VIII.—MAKING AND REPAIRING AGRICULTURAL IMPLEMENTS.

VILLAGE smiths in agricultural districts find most of their employment in making and repairing the implements tools, vehicles, etc., used on the neighbouring farms, and in shoeing the farmers' horses. Some fifty years ago there was abundant employment in each English agricultural village for two or three smiths and their apprentices; but the industry has changed since then. New systems of farming and cultivation have been introduced, and the old system, with its time-honoured brawny village smiths, has passed away.

Under the old system of farming—when each farmer employed several teams of horses to cultivate his land with home-made ploughs, harrows, scarifiers, and rollers—the village smith, together with the village carpenter, not only kept those implements in working order, but also made them. Hence we had ploughs with wooden beams and grit-boards; harrows and scarifiers with wooden frames, and also wooden rollers. These various implements were fitted by the smith with iron work, and thus the two village worthies ministered to their neighbours' wants.

The first departure from this system of co-operation was marked by the advent of the first iron plough, followed soon after by iron scarifiers, cultivators, harrows, and clod-crushers. Where villages expanded into small towns, the smithies became enlarged into factories worked by steam power, wherein the smiths laboured to turn out iron implements of husbandry by means of such large forgings as were impossible of imitation in country smithies. From that time the work of village smiths has been confined to the repair of agricultural implements in those districts where the more modern system of steam cultivation has not driven the plough teams out of the fields.

Some splendid specimens of iron ploughs, harrows, cultivators, and other farm implements, have been turned out of hand by such firms as those of Messrs. Hornsby of Grantham, Howard of Bedford, Ransome of Ipswich, and Brenton of St. Germans, and still continue to be made by them or their successors in the business. The special work of making implements is therefore taken up by those large firms n such a manner as to make such work unremunerative to the village smith. But there are certain wearing parts of those implements which are continually needing repair, and to these we now turn our attention.

Ploughs.—Iron ploughs of superior make and finish may now be bought at a less cost than they can be made by the amateur smith. As, for instance, the R. H. A., or Pony Plough, of Messrs. Ransome's, weight 1 cwt., price £2 5s. The classes generally in use, are the single plough (with one breast or "turn-furrow" only) and double-breast ploughs (with two breasts or "turn-furrows") in several varieties. The double-breast ploughs are in use for hillside ploughing and in localities where single ploughs are inadmissible. Both single and double ploughs of modern make and design are furnished with chilled cast iron "shares" in duplicate to any number required. Therefore, when a "share" is worn out, it is thrown aside and a new one substituted. The other wearing part of a plough is the "coulter," and this part is not supplied by all makers in duplicate, but has to be frequently repaired by the village smith. Fig. 125 shows a form of coulter as supplied with some modern iron ploughs. Fig. 126 shows the same coulter much worn and needing repair. Coulters are made of best iron with a cutting edge of steel welded to the front and point of the blade. The blade is made long enough in a new coulter to admit of some wear before it becomes necessary to renew the blade, the shank being also made long enough to stand well up above the beam of the plough, and to allow of being lowered as the blade wears away. When the blade needs repairing for the first time, and for several times subsequently, it is only necessary to take a heat on the point of the blade and restore it to its original shape and sharpness by hammering it out on the anvil. But sooner or later the coulter assumes the shape shown in Fig. 126, and even that shown by the lower dotted line in that figure. The greater part of its steel edge is then worn away, and the blade must be "layed," that is, made up anew by welding iron and steel to it. This is done in the following manner: Place a thin piece of good shear steel on the blade in the position indicated by the diagonal line A B in Fig. 126; overlap this with a piece of good iron, as shown by the dotted line C D, grip the whole with a pair of crooked tongs secured by a link on the handles, heat the whole to a welding heat, then draw out and forge to the required shape. Whilst heating the whole up to a welding heat, carefully watch the steel and prevent it from burning by dusting it with a little silicious sand, or with crushed limestone, or powdered marble.

Fig. 127 illustrates the form of coulter in use with the old style double ploughs. These coulters are hung in the beam of the plough to a bolt passing through one of the holes in the shank, shown in the sketch, and are thus free to be moved by a tiller from left to right, or the contrary, as required, when the "turn-

furrow" or breast is moved. The shank is pierced with five or six of these holes about an inch apart, and thus provision is made for raising or lowering the coulter, the latter being necessary as the point wears away. A coulter with the point much worn is shown at Fig. 128, where the diagonal crooked line shows a much worse condition, the peculiar curve near the upper part of the edge being due to an absence of steel, or soft steel in that part, or, as sometimes happens, undue wear caused by a layer of sharp wet grit near the surface of the ground in which the coulter has been used. Coulters for deep ploughing should always be steeled high up on the front edge, as shown by the dotted vertical line on Fig. 127. The repair of this class of coulters will be similar to that of the last.

Fig. 129 shows a wrought-iron ploughshare in use with old style double ploughs. It is made of best iron, steeled from the point back to one-half of the blade, as shown by the curved line in the figure. This share is secured to the shoe of the plough by two bolts passing through the two holes shown in the sketch. It will be noticed that the front hole of the two, that is, the hole nearest the point of the share, is not round, but is elongated in a direction across the width of the share. This peculiarity allows the share to be adjusted to run to right or left, as may be required. Fig. 130 shows the share out of repair, when it must be repaired after the same method as that employed in repairing coulters. Shares will wear round at the corners and get blunt, when they will require to be heated, upset at the point and drawn out afresh.

Fig. 131 shows a peculiar-shaped share used with old-fashioned iron single ploughs in felling or skimming grass grounds and arishes. It is made of best iron steeled at the point and front edge, as shown by the curved line in the sketch, and with from half to three-quarters of an inch of the wing turned up to cut and cripple the sod as it is being turned over. A share for a similar purpose, in use with the old-fashioned wooden ploughs and made to fit the wooden shoe of those ploughs, is shown at Fig. 132. It will be readily observed that this share forms an important link in the evolution of ploughshares, since it closely resembles the form of the modern cast-iron shares now in use. I have deemed it desirable to thus describe and illustrate these old-fashioned implements, to meet the requirements of those who may be using them.

Makers of modern ploughs differ in the shapes given by them to the coulter, but agree generally in the form of ploughshare. Fig. 133 shows the coulter in use with Ransome's ploughs. Figs. 134—135 show two forms of coulter in use with ploughs made by Hornsby and Son. The plough sent out by Messrs. Kell, Meats, and Co., are furnished with coulters as shown at Fig. 125, but this firm also supplies a coulter with a chilled cast-iron blade, easily repaired with a new blade when the old one is worn out, at a cost of only 8s. per dozen blades. Fig. 136 shows the disc coulter of Messrs. Ransome, or the "skeith" coulter of Messrs. Hornsby, implements of a similar construction, of great use in rough ground abounding in tough fibrous roots. These are easily repaired with new discs. Figs. 137—145 show the various cast-iron shares in use with modern ploughs, from which it will be seen that they are adapted to all requirements.

Cultivators and Scarifiers. — These important farm implements are used for the double purpose of stirring the surface soil of fields, and so assist in promoting its drainage and æration, and in clearing the soil of weeds by cutting them off just beneath the surface. The cultivator is formed of a heavy triangular frame of wrought iron, mounted on three and sometimes four wheels, and fitted with several tines, shaped as shown in Fig. 146. It will be seen from the sketch that each tine is furnished with an arrow-head shaped blade of iron and steel, bent forward to form the foot of the tine. This foot must have sharp cutting edges of steel if it is intended to be used in cutting weeds. This part, as the wearing part of the implement, will frequently need repairing, much the same as a ploughshare. In some forms of this implement sent out by the best modern makers, the foot of the tine is short, and bent forward to form a toe, on which is fitted a blade, furnished with a socket to fit the toe, just as a ploughshare is made to fit the toe of a plough shoe. If the blade is made of wrought iron and steel, it can be struck off and repaired without moving the implement to the smithy; but if made of cast iron, it is worked until worn out, and then a new blade substituted for the worn out one. The predecessor of the cultivator was a heavy wooden implement of a similar shape, fitted with tines, shaped as shown at Fig. 147. These tines are made to dip down into the soil and thus rip it up as the implement is being drawn along. The scarifier is a wider implement, carrying two rows only of smaller tines, but in other particulars similar to those shown at Fig. 147. They are made and repaired as those of the cultivator, being sharpened or "layed" as required by their condition. The work of making the wrought-iron tines of these implements, and also coulters, and wrought-iron ploughshares, is exceptionally heavy, and, therefore, should only be undertaken when the smith can command the assistance of two lusty strikers with heavy sledges.

Harrows.—The work of making harrows and harrow tines, and also repairing the wearing parts of these implements, may be readily undertaken by a smith working single handed. The old form of common harrow is simply a latticed frame of wood or scantlings. The tines are 8 inches in length, and forged out of best inch square bar iron to the form shown at Fig. 149. These are driven tight into square holes cut in the scantlings, 9 inches apart. The frame is drawn along by one of the corners, to which a

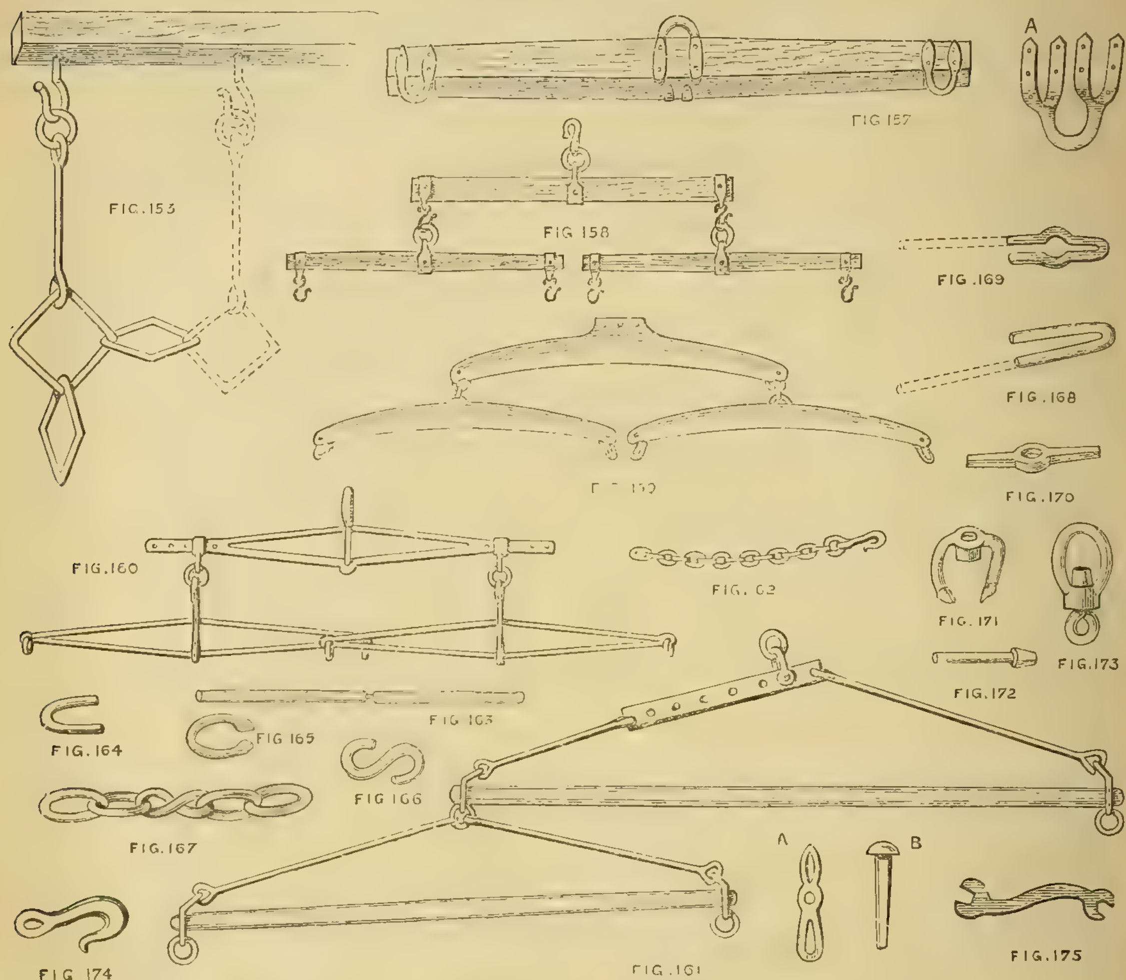


FIG. 153.—METHOD OF CONNECTING LINKS OF CHAIN HARROWS TO EACH OTHER AND TO WHIPPLE TREE. FIG. 157.—DOUBLE WOODEN WHIPPLE TREE, OLD STYLE, IMPROVED STAPLES. FIG. 158.—HORNSBY'S WOODEN WHIPPLE TREE. FIG. 159.—SLEEP'S PATENT STEEL WHIPPLE TREE. FIG. 160.—RANSOMES' PATENT STEEL WHIPPLE TREE. FIG. 161.—TUBULAR IRON WHIPPLE TREE. FIG. 162.—LIGHT TRACE CHAIN. FIG. 163.—ROD OF IRON NICKED TO LENGTH OF LINK. FIG. 164.—LINK CUT OFF AND BENT. FIG. 165.—LINK SCARFED READY FOR WELDING. FIG. 166.—S HOOK FOR TEMPORARY REPAIRS. FIG. 167.—MODE OF USING S HOOK. FIG. 168.—FIRST STAGE IN MAKING SWIVEL. FIG. 169.—SECOND DITTO. FIG. 170.—THIRD DITTO. FIG. 171.—FOURTH DITTO. FIG. 172.—SWIVEL PIN. FIG. 173.—SWIVEL FINISHED. FIG. 174.—HOOK OF PLOUGH CHAIN. FIG. 175.—PLOUGH SPANNER.

U-shaped loop of $\frac{3}{4}$ inch round iron is secured. The old style of iron harrow followed closely the lines of its wooden predecessor in being a square frame of similar dimensions, furnished with tines. The iron used was 1 inch by $\frac{3}{8}$ inch bar iron, twelve lengths of 5 feet each, placed transversely and bolted together by the screwed shanks of such tines as those shown iron, furnished with a tine shaped as Fig. 148, or Fig. 149, at each corner of the frame and each corner of the latticed square. The old fashioned wooden harrow is composed of a frame of six oak or ash scantlings, 5 feet by 3 inches by $2\frac{1}{2}$ inches, secured transversely at distances of 6 or 7 inches by four oak battens, 3 inches by 1 inch, mortised through the

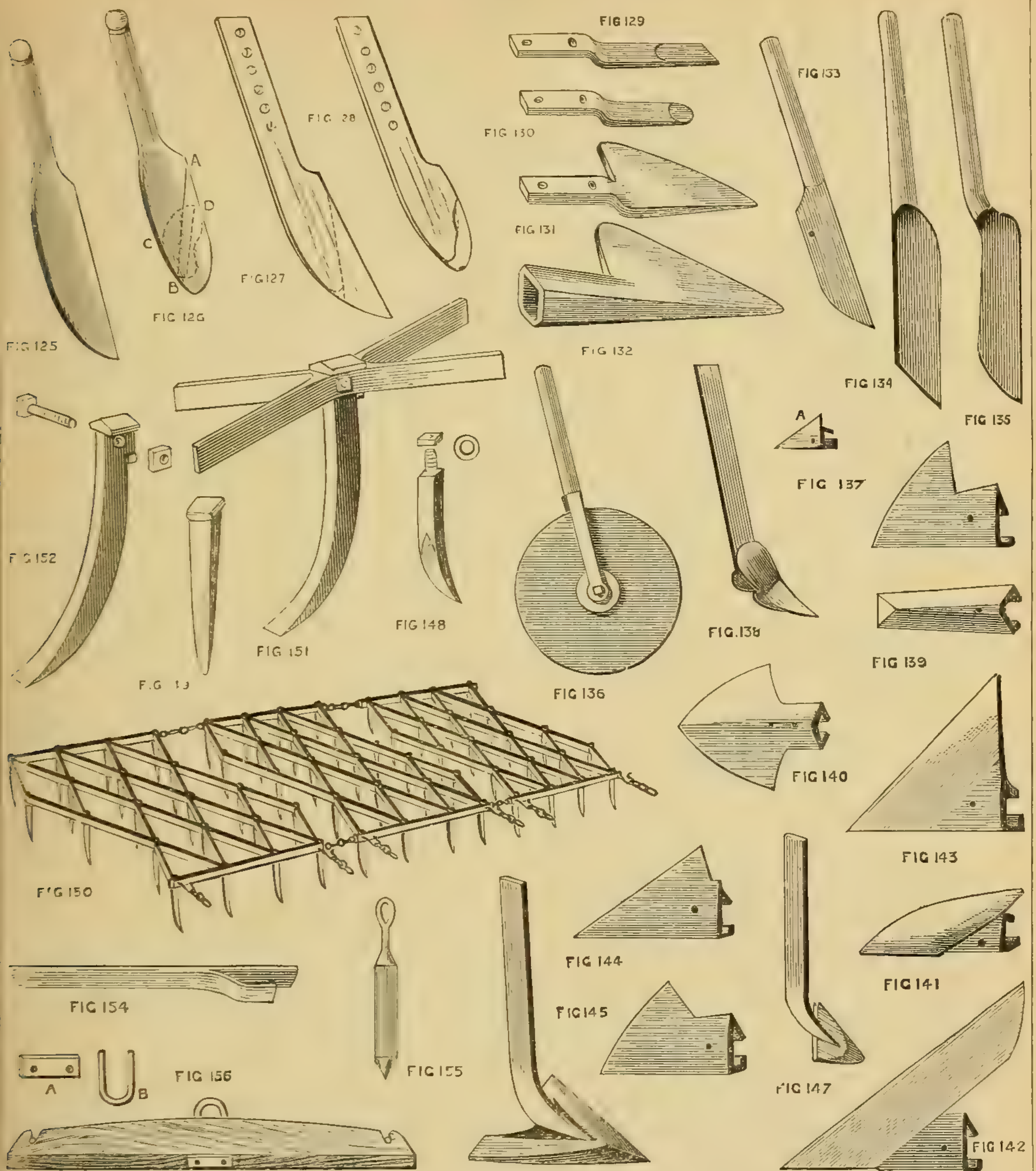


FIG. 125.—PLOUGH COULTER. FIG. 126.—PLOUGH COULTER OUT OF REPAIR. FIG. 127.—OLD STYLE COULTER. FIG. 128.—OLD COULTER WORN. FIG. 129.—OLD STYLE PLOUGHSHARE. FIG. 130.—DITTO, NEEDING REPAIR. FIG. 131.—SKIM SHARE, OLD STYLE. FIG. 132.—SKIM WOODEN SHOE PLOUGH. FIG. 133.—RANSOMES' KNIFE COULTER. FIG. 134.—HORNSBY'S KNIFE COULTER. FIG. 135.—HORNSBY'S HIGH-CUT COULTER. FIG. 136.—RANSOMES' DISC COULTER. FIG. 137.—CAST-IRON PLOUGHSHARE. FIG. 138.—SKIM COULTER AND SHARE. FIG. 139.—SUBSOILING SHARE. FIG. 140.—RIDGING SHARE. FIG. 141.—SETTING-OUT SHARE. FIG. 142.—PARING SHARE. FIGS. 143, 144, 145.—CHILLED IRON SHARES. FIG. 146.—TINE OF CULTIVATOR, OLD STYLE. FIG. 147.—TINE OF TORMENTOR, OLD STYLE. FIG. 148.—TINE OF IRON HARROW, OLD STYLE. FIG. 149.—TINE OF WOODEN HARROW, OLD STYLE. FIG. 150.—ZIG-ZAG HARROWS, LINKED. FIGS. 151, 152.—KELL, MEATS AND CO.'S IMPROVED HARROW TINES, AND METHOD OF SECURING THEM. FIG. 154.—FORK OF HARROW STRETCHER. FIG 155.—TAIL WEIGHT OF CHAIN HARROW, OLD WHIPPLE TREE, STAPLE, AND GUARD.

at Fig. 148. Modern harrows are made of much lighter metal, with the bars arranged in parallel zig-zags, as shown at Fig. 150. The tines are small in the light iron harrows, and are placed at distances of 6 inches apart. Figs. 151 and 152 show a special form of harrow tine adopted by Messrs. Kell, Meats, and Co., *Gloucester*. The harrow is also made up in two or three sections secured to each other whilst in work by short chains. Harrows should be hung for draught in such a manner as to cause the tines to follow each other in the spaces between those preceding them. Best tines are steel tipped, and they are subject to the same wear and consequent repair as those of scarifiers and cultivators.

Chain Harrows are quite modern implements. They are composed of—as the name implies—a number of chains or square links of iron fastened together, and kept in position by transverse rods or spreaders of iron. Their use is to draw over stubble or grass lands already broken up with cultivator or scarifier, and shake up the grass or stubble to free the roots of weeds from adhering soil. For this purpose, I know of no other implement equally useful. Chain harrows can be easily made by an amateur smith. Small rod iron of square section is used in two sizes, $\frac{5}{16}$ inch and $\frac{3}{8}$ inch. The links are made in $3\frac{3}{8}$ inches diagonal meshes. The full dimensions may be either $9\frac{1}{2}$ feet by $7\frac{1}{2}$ feet, $7\frac{1}{2}$ feet by $7\frac{1}{2}$ feet, or 5 feet by 6 feet. The latter will be suitable to the strength of a pony. The first two-thirds of the harrow should be made out of $\frac{5}{16}$ inch iron in $3\frac{3}{8}$ inch meshes—that is, $3\frac{3}{8}$ inches across the link diagonally. Cut off twenty-five 10-inch lengths of $\frac{5}{16}$ inch iron, make into links, and weld each link to form a chain. Then make a similar chain of the same length, and connect the two together by each alternate link with links of the same size. Then make another chain and connect to the last in a similar manner, and thus proceed until two-thirds the length of the harrow is formed. Then make the remaining one-third with $\frac{3}{8}$ inch iron in a similar manner. The smaller sized harrow will require fifteen 10-inch lengths of iron made into links of $3\frac{3}{8}$ inch mesh to form the first chain. Then proceed with the remainder as above directed. The arrangements for drawing the mat of chains is as follows. Into the two outside links and each alternate link of the first chain is connected a 6 inch bar link of $\frac{3}{8}$ inch round iron rod, and the corresponding end of each bar link is furnished with an oval link. These oval links are hitched on to hooks inserted in a whipple-tree extending the whole breadth of the harrow. Fig. 153 shows how each link should be thus connected. To prevent the harrow from matting, and to keep it spread out over the ground whilst being drawn along, it is furnished with two iron or steel spreaders stretched across the breadth of the harrow, and furnished with forks at each end, made to fit the links on each side.

The forms given to these spreaders vary with different makers. A useful spreader can be made out of flexible spring steel, 1 inch by $\frac{1}{8}$ inch. Weld a short piece of steel to each end to form a fork as shown at Fig. 154. The spreader should pass through two rings fixed to the sixth link from each side, and then be made to engage with its forks the two outside links of the harrow one-third from either end. The two rings prevent the spreader from buckling after its forks have been forced into the outside links. Chain harrows must also be furnished with tail weights, to keep the hindermost links from being flung forward when passing over rolls of stubble. Four of these will be desirable. One of such weights is shown at Fig. 155. It may be made of cast iron with a wrought iron tang and eye, or be forged out of 1 inch round bar iron. Length from four to five inches each weight. The sketch (Fig. 153) is taken from one of the old style harrows with a wooden whippletree; modern chain harrows are fitted with iron tubular whipple-trees, and these can be easily made out of gas pipe. Readers wishing to buy a light chain harrow complete from the maker, will find their wants met by applying to Messrs. Bayliss, Jones, and Bayliss, *Victoria Works*, *Wolverhampton*, who sell their patent wrought iron light chain harrows, 6 feet by 5 feet, at the low price of £1 14s. These harrows are of excellent quality and make, being furnished with tubular whipple-trees and elastic steel expander, a decided improvement on iron stretchers for keeping the harrow to its full width.

Whipple-trees.—These are the lateral spreaders to which the traces of farm-horses are fastened whilst they are at work drawing ploughs, harrows, etc., over the fields. The old form of single whipple-tree is shown at Fig. 156. It is made of tough ash wood, 3 inches by 2 inches, and from $2\frac{1}{2}$ to 3 feet in length, shaped as shown in sketch Fig. 156, wherein A and B show clearly the staple and guard used with this form. This is a most clumsy and defective form, although largely in use. Fig. 157 shows a double whipple-tree with one of the defects removed by the use of clasping staples, forged as shown, Fig. 157, A. These clasp the wood instead of piercing it, and thus add to its strength, but the form is unnecessarily massive.

Fig. 158 shows the improved two-horse wood whipple-trees of Messrs. Hornsby and Son, *Grantham*. In this form the clamps are made in ferrule shape and fitted on over the ends of the whipple-trees, being secured in position by clout-headed nails. Fig. 159 shows a departure from the use of wood to that of iron and steel in the manufacture of whipple-trees,

These are made out of U section steel, and are light and strong. The hooks for the traces are pivoted into the ends of the trees and the points are turned inward. They are made and sold by Messrs. Kell, Meats, and Co., *Gloucester*, at 18s. 6d. the set. Fig. 160 shows a set of patent steel whipple-trees made by Messrs. Ransomes, *Ipswich*, on the trussed girder principle, thus ensuring lightness with strength. The price is 17s. 6d. Fig. 161 represents a part set of iron whipple-trees, light and strong, and of simple construction. The spreader may be of 1 inch gas barrel, from 2½ to 3 feet in length for the single, and from 3½ to 4½ feet for the double whipple-tree. The adjustable perforated draught-bar may be made out of a 1 foot length of 1 by $\frac{7}{16}$ inch flat iron, and the connecting rods of ⅝ inch iron. The end pieces, shaped as shown in Fig. 161, A, are secured by pins (Fig. 161, B) fitted into the ends of the gas barrel and riveted over. All new forms of whipple-trees are furnished with means for adjusting the draught, and thus apportioning it to the strength of each horse. By this means a weak horse and a strong animal may be worked side by side, each doing its share of the work according to its strength. The traces in general use with farm-horses are light iron chains with small links, as shown at Fig. 162. These terminate with a hook if they are to be used with such whipple-trees as those shown at Figs. 160 and 161, or with a ring when used with those shown at Figs. 156, 158, and 159. Hempen ropes are also in use as traces for farm-work.

Making and Mending Chains.—Short plough chains and trace chains may be made and mended by an amateur smith. The method of doing this is shown by Figs. 163 to 167. Measure the length of a link in the chain, add one-third to this, and the total will give the required length of iron for an oval link. The length of iron for a round link is a little over three times its diameter. Nick off the required length as shown in Fig. 163; heat this in the middle to a red heat, bend as shown in Fig. 164, and cut off; then scarf the two ends as shown in Fig. 165; heat to a welding heat, close up, and weld to form the link. Place the next link in this before closing it, and thus proceed to make the chain. It sometimes happens that a chain is broken in the field when it is inconvenient to have it mended at the smithy. In such cases it is well to be provided with a few S-hooks, shaped as shown at Fig. 166. With these a chain may be temporarily mended, the ends of the hook being bent over the links of the broken chain as shown at Fig. 167. The iron for S- ooks must be tough, and the hooks must be cooled gradually when made.

Figs. 168 to 173 show how a swivel link may be made. Cut off a piece of iron as for a round link, double it as shown in Fig. 168, form it to shape shown at Fig. 169 over the beck of the anvil; weld the two ends together and draw them out as shown in Fig. 170; then form and bend over, and scarf, as shown in Fig. 171. Next forge the swivel pin (Fig. 172). Place this in the boss of the swivel, weld up the eye, and finish off as shown in Fig. 173. Fig. 174 shows a hook for a plough chain, and Fig. 175 shows a two-ended plough spanner. These must be forged out of good iron or steel, since they have to stand rough usage.

There are many other implements and appliances used on farms, all of which are liable to be broken, and will require the smith's attention to be repaired. I cannot even enumerate all the possible requirements for his services, but he should now be able to meet them all by the exercise of a little ingenuity and perseverance. A few hints on how to mend iron fences and gates, and how to repair such tools as forks, picks, mill-bills, etc., may be acceptable; but these must stand over to form the subject of my next article.

(*To be continued.*)

PATTERN MAKING FOR AMATEURS.

By ARTHUR J. SCOTT.

II.—TOOLS FOR PATTERN MAKING THAT MAY BE MADE AT HOME.

IN referring to the first article, you will there find a list of a kit of tools, some of which you could not very well purchase at the ordinary tool shops. I shall here describe a few which the amateur will, I believe, have no difficulty in making for himself if he will only take care to arm himself with a little perseverance.

In Figs. 11 and 12 we have two views of a very handy bow saw; this is a tool you could purchase at a tool shop, but examine the design and finish of those usually sold, and the price as well, and then I think you will agree with me when I say, "Make one yourself; it will both be best and cheapest."

It is drawn exactly quarter-size, or 3 inches to a foot; so there will be no trouble in getting the dimensions. The wood I should prefer would be either beech or lancewood. You want a very strong wood for it, and I should not advise making it out of any other kind only the two spoken of. If you do, you must not be surprised some day, when in the middle of a job, some part of it breaks down. And now to work.

The two end-pieces, A, A, are each 14½ inches long,

so you will want two pieces a little over that length and $1\frac{3}{4}$ inch broad to make up the curved part. The curves are struck out with a radius of 21 inches, but this is optional; at B, Fig. 11, are the brass pins which hold the saw in its place, held there by a saw kerf cut in the pins, with a small hole drilled in and a sprig drove through. These same pins are tapped into the handles, and at one extremity of the handles have a brass collar, as at C, Fig. 11. You will be able but, at the same time, come easily asunder. It is oval in section, tapering rather more than shown in the sketch towards the centre ; you will perceive from the other view, it tapers both ways. F is what I will call a bobbin : its duty is, with the assistance of E, to tighten the string G, or twist it, thereby tightening the saw K. At L we have an end view of F, somewhat elliptical in form, only pointed at the two extremes. Where the string surrounds F, cut a groove with a

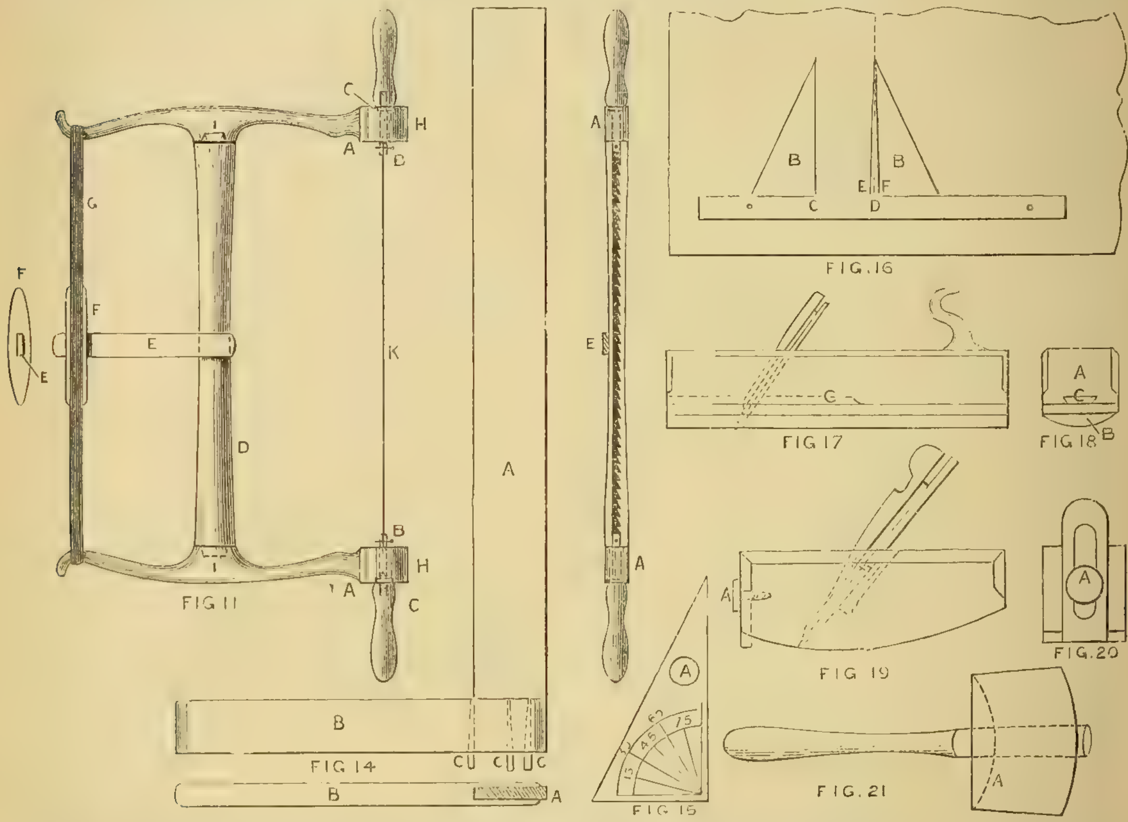


FIG. 11.—BOW SAW, SIDE VIEW. FIG. 12.—BOW SAW, EDGE VIEW. FIG. 13.—LARGE SQUARE, PLAN. FIG. 14.—LARGE SQUARE, EDGE VIEW. (Figs. 11, 12, 13 14, on Scale of $1\frac{1}{2}$ inches to 1 foot: other Figs. not to Scale.) FIG. 15.—MODE OF SETTING OUT SET-SQUARE. FIG. 16.—MODE OF TESTING SET-SQUARE. FIG. 17.—ROUND SOLE JACK PLANE, SIDE ELEVATION. FIG. 18.—DITTO, END VIEW. FIG. 19.—SKIP-JACK SMOOTHING PLANE. FIG. 20.—DITTO, END VIEW. FIG. 21.—MODE OF MAKING MALLET.

to procure these handles at any tool shop almost, for you will find it a deal of trouble making them, and hardly repay you for the time spent on them. Let the holes which are bored in the end-pieces, A, A, for the pins be a tight fit, as you don't want the saw handles to be turning round all the time while you are sawing. On the two outside edges of A, A, work it to a semicircle, dying away to a square edge at the handle end. You will also perceive that the end of ditto, marked H, is worked to a semicircle. The stock D is mortised into the two frame ends, as shown at I, I, but not fastened in. Let it be a good fit, paring gouge on either side. By so doing you will prevent the string from coming off. The piece E is merely a strong slip of wood working loosely in the slot F. You will, I think, perceive the working of the saw now without any explanation ; only after using *always* slacken the string G, to take the tension off.

In Figs. 13 and 14 we have two views showing the method of making a large wooden square, drawn quarter size, or 3 inches to a foot. The wood best suited would be some good old dry mahogany, or next to that, old oak. Whichever you use it must be well dried and seasoned, free from shakes or knots. In

Fig. 13 we have the plan of square; Fig. 14, edge view, A representing the blade, and B the stock. The method of mortising stock will be easily seen from Fig. 13, C, C, C, being wedges to tighten the blade in place, afterwards being dressed off level with the base of square.

In gluing up, if not in possession of a large set-square, fasten two strips on a board something after the manner of Fig. 16, only at right angles to each other, which line can be easily obtained by the use of trammels. By keeping the inside edges of A and B close to these strips, you should not knock it far out of truth in gluing up. Any little discrepancies then can be easily seen in testing the square in the same manner as the set-square described next. Fig. 15 represents a handy way to set out ordinary set-squares. By putting your bevel along either of its straight-edges you can obtain any bevel you may be requiring, the hole A being made by a centre-bit, and is very useful for hanging it up by.

Fig. 16 represents the method of testing set-squares to see whether true or not, as one untrue is practically useless. At A we have any ordinary board with strip C loosely sprigged to it, D being a perpendicular line from the face of C; but it is not required to draw that line on the board A, as the set-square B would form it if absolutely true. Now for trying it, when the top edge of B was touching the vertical line D, the line E was described from the edge. The set-square now being turned round, described the line F, so you see when the square is turned round, whatever it is out of truth in the first instance, from the line first drawn to the perpendicular line, is exactly double, so that you cannot be too particular in getting all your tools true.

Fig. 17 shows a side elevation of a round sole jack plane with loose soles; Fig. 18 being an end view of ditto, the construction of which will be seen from the two views shown. In length it is about 14 inches long, 2½ inches broad, and 2 inches thick to the joint of the loose sole B, which is fitted into the body A by a dovetail, as shown at C. The angle of the iron being at about 50°, the slot will require mortising out to that angle, double irons being used. In making this plane you should make about half-dozen loose soles, as they come in so very handy for so many kinds of work with radiuses at about 4, 6, 9, 12, 18, and 24 inches. These will be found sufficient for all ordinary purposes. Of course, every loose sole will require a different back iron ground to the radius required.

At Fig. 19 we have a side elevation of a skip-jack smoothing plane. The only difference in this and an ordinary one is the arched bottom and the dovetail tongue at the front, which slides up and down in a dovetail joint, being fastened where required by the screw A. This tongue ought to have a brass plate extending nearly to the bottom to strengthen it. The irons have an angle at about 50°, as in the plane previously described.

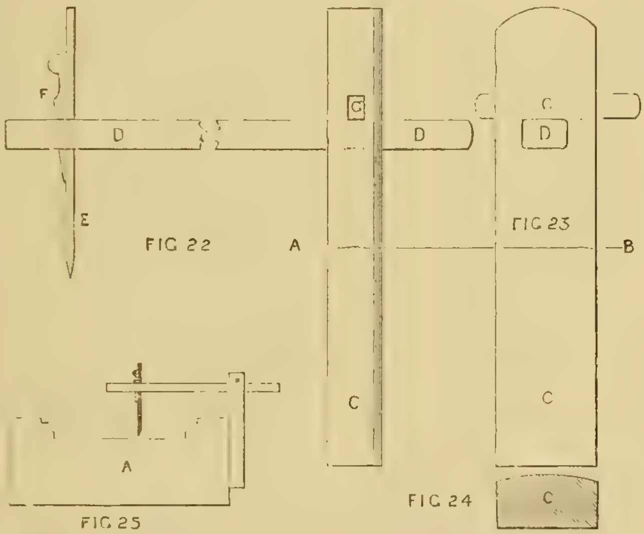


FIG. 22.—LONG TOOTH GAUGE, SIDE ELEVATION. FIG. 23.—DITTO, END ELEVATION. FIG. 24.—SECTION THROUGH A B. Scale of Figs. 22, 23, 24, 3 in. to 1 ft. FIG. 25.—MODE OF USING LONG TOOTH GAUGE.

At Fig. 21 we have an ordinary mallet, yet not an ordinary one, because you will be required to get a little more work in it than those usually sold in shops. The head comes off loose simply by knocking the end of the shaft, the shaft being somewhat oblong in section at the head part, but verging away into an oval section towards the handle. I have seen some mallets, the inside form to follow the curve of the outside, as shown by the dotted line A. You will perceive how dreadfully weak you make the head by doing so, as the corners thus left will be sure to break off; therefore, make yours straight across as shown. The hole in the head can be bored through by a centre-bit and finished by an ordinary chisel. Make it a good fit without any shake in it, and you will have as good a mallet then as you will wish for.

Figs. 22, 23, and 24, represent three views of a long tooth gauge; Fig. 25 representing the method of using the same. The drawings are quarter-size, so the dimensions can be easily got off them. In Fig 22 we have a side elevation, C, representing the stock, which you will see from the section shown in Fig. 24, is curved on one side a little. This is to enable it, if required to gauge inside circular work, the flat edge

being used for ordinary work. I must still advocate my favourite wood, beech, for this gauge, as it will, I believe, answer all requirements wanted of it. Mortise out the wedge-hole G and the hole for the staff D, make each of them good fits, the staff D to fit the same all over its length; E is a strip of steel ground to a jutting edge about $\frac{1}{4}$ inch broad and full $\frac{1}{8}$ inch thick, which is held and regulated by the wedge F.

Fig. 25 shows the method of working the gauge. Suppose it is required to get a centre line on a length the section of A; well, this would be very difficult to be done by the ordinary gauge, so here you will see the usefulness of the tool I put before you, as you will see from the illustrations there would be no difficulty at all with this gauge.

A word now regarding some other tools used by the amateur. In grinding turning tools I should advise grinding all a short bevel, as if not, they will dig in the timber being turned, which being anything but pleasant, it is best to avoid.

Now for the handles. You cannot err very well in making them too long, 8 inches in length being none too long for a handle belonging to a short turning gouge. By making them too short you incur great risk of spoiling your work by not having sufficient leverage, etc. Next, always keep them sharp, as turning tools in particular want to be, if you feel any pride in the work you are doing.

In buying tools do not think you have been sold in them if at the first time of grinding, etc., you find them very soft or too hard. Grind again a few more times before taking back, as some of the best-tempered tools now in my possession was either one way or the other until I had ground them a few times and sharpened. So at first don't give them up before giving a few trials. If after a many times grinding you still can't get an edge on, take it back to the ironmonger, who will exchange it for you. A word of advice here: "Don't buy any tools at any tool shop who won't guarantee their goods and who won't allow you to change if wrong."

In regard to the oilstone, there is much difference of opinion on this subject. Take, for instance, you go and ask an experienced workman what he thinks are the best kind of stones. "Oh!" he will say, "there is nothing like a Turkey." Another will say, "No stones can beat the Charnley Forest." So there you are. The stones I like are the following for turning tools, jack plane iron, and all irons which soon has a thick edge in being used: I use a "Washita," which I find cuts very quick, and just suits for the purpose. For a keen edge I use a Charnley Forest, which I have found none to supersede as yet. The gouge slips I use are Turkey slips, so you will see I vary in them all. My advice to the amateur is, if you can afford all the three, get them; but if only one, get a Turkey as I think you will find it not only cuts quick, but gives a keen edge. A stone is a simple thing to look at, but I don't think there is any tool upon which such a variety of opinions exist among wood-workers in general as an oilstone. In referring to the list of tools given in first article, you will find mention there made of winding strips and carving tools. In regard to the former I must refer the reader to Mr. Thomson's paper on the Microscope, where they will find a pair described; but, at the same time, I should advise the amateur to make a smaller pair for ordinary use, about twelve or fourteen inches long, any odd lengths of dry mahogany as he will have by him, and make them according to Mr. Thomson's instructions. In regard to the latter, the carving tools, I should most certainly prefer Addis's make to any other. I believe I mentioned about a dozen or eighteen. They would be best grouped as follows:—About half-a-dozen cranked spoon gouges, different radiuses, three different widths of cranked chisels, four or five ordinary bent carving gouges, and four or five outside ground straight gouges. The handles you may get at the same place where you get the gouges; if not, Gleaves of *Oldham Street*, *Manchester*, will sell you any number at 2d. each, boxwood, the right sort for the purpose—in fact, I don't know how they can be made for the money. I can recommend these handles to any amateur who may be wanting any.

One of the chief things needed in an amateur workshop, I am sure, must be a good straight-edge; so suppose for a little while we steer for our bench and make a *good* one. But before we begin, let us examine the bench a little while, and see whether we can't improve it a little first. We find on coming to it that the wedge is about 18 inches to the left of the bench screw, so every time we are planing anything up we are up against the screw. "Oh!" you will say "it has its advantages." Yes, it has, I will acknowledge, and it has its disadvantages, one of which I have just spoken of, and that is a very great one, in my humble estimation. What are then its advantages? It has only one that I know of; it is this: it enables you to plane a longer piece up than you otherwise could do. But why should that stop you having another wedge a little on this side of the bench screw, where you could plane up all your ordinary work without bruising your legs up against the bench screw? So we will put another one in, and we will then look at our vice or screw, and examine that. When we come to it we find that although our screw is as tight as possible it still won't hold our timber steady; so we will remedy that by fastening two gripping pieces of beech or birch to the top of the bench and loose leg, each of them about 4 or 5 inches broad and $\frac{7}{8}$ inch

in thickness. Now we are all right; but when we come to examine the bench we find out a mistake we made in making it. Still, it is not different than most people's, but we think this idea would be better: instead of having the edge of the top plank to come level with the face of the bench, to let it project out about two inches, the recess thus formed being out of your way, would enable you to plane timber up better edgewise by not catching up against the side of the bench. It would enable you to cramp anything to the bench by the projecting ledge; it would enable you in the recess thus formed underneath, of hanging anything up; and, lastly, it would enable you much better to shoot up straight the front edge of your bench, so weighing all this up, we are determined to alter it on the first opportunity.

We now commence on the straight-edge already spoken about, and find a very dry piece of St. John's pine about 3 ft. long, $4\frac{1}{2}$ in. broad, and $\frac{5}{8}$ in. in thickness. We plane it parallel in thickness, then plane one edge square with the side, and then test its straightness by drawing a line on a board, the said line being formed by the square edge; we then turn it over to see whether it coincides with the line first drawn. It does not; it is hollow. We take a little off both of the ends, and are more successful this time. Well, having got one edge straight, we gauge a line off the squared and straight-edge, and plane to it. Try as before, and then we have a good straight-edge for further use. In course of time, however, the wood will shrink and alter its straightness, and will require truing up again.

(*To be continued.*)

DRY-PLATE PHOTOGRAPHY:

THE GELATINO-BROMIDE PROCESS.

By C. C. VEVERS.

VIII.—HEAD AND BUST PORTRAITURE—BACKGROUND —REFLECTOR AND ACCESSORIES—DRESS—POSING AND LIGHTING.

ONE of the principal causes of an amateur's failure in portraiture arises from his slowness in posing and manipulating the camera before exposure. A sitter, however happy may be his mood and pleasant his expression when he first takes his place before the lens, is very soon wearied of sitting in one fixed position, the contented smile quickly disappears from his face, the corners of his mouth fall, and his features soon assume a dejected and tired appearance, and although he may afterwards attempt to force a pleasant expression, it is often most perceptibly artificial, and so it will appear in the photograph.

The beginner would do well to practice thoroughly the various stages of focussing, posing, and lighting, with some inanimate object—a plaster cast for example—before attempting the same with his sitter. Before taking a portrait, always see that everything that will or *may* be required, is at hand, so that the sitter may not be kept waiting longer than can be helped; arrange the background and accessories, fix up the camera, and obtain the focus roughly before bringing the sitter upon the scene. The operator should know exactly in what style his sitter wishes to be photographed before placing him before the background, and he should arrange his accessories accordingly, so that no time may be wasted afterwards. Many people become as nervous when in the photographers, as in the dentist's chair, and it is the operator's duty to keep up a cheerful conversation, and make his sitter feel as much at ease as possible, for if nervousness predominates, an unnatural picture will certainly ensue.

Head and shoulders, or head and bust portraits, are subjects that require a great amount of care and delicate lighting to do the sitter justice, and bring them near the standard of professional work; in this branch of portraiture more than in any other, if possible, no trouble should be spared to procure the best results, every little detail in lighting and posing should be studied, and no possible improvement in either should be passed over because "it's not worth the trouble."

If the amateur has a room with a bay window, or even a large flat window, at his disposal, he will, if he spare no pains in preparation, obtain the most satisfactory head and bust portraits indoors. I say advisedly "if he spare no pains," for unless he is gifted with a large amount of patience, and is prepared to find it severely tried, I should advise him to leave head and bust portraiture to the professional, or at all events, work outside, where the light is more rapid, under the screen described in the last chapter. If, however, care be observed, portraits may be taken so delicately lighted as to equal, and in many instances surpass, a professional's ordinary work, by the aid of nothing but a few reflectors, background, head-rest, and a judicious distribution of diffused light.

The following are the requirements for indoor portraiture: A window of the bay or bow form, if possible, facing, preferably, north, or north-east or west; the light coming from a northerly direction is much more steady and uniform than when coming from the opposite direction, but very good photos may be obtained with a southern light if a window facing north is not obtainable. A head-rest will be essential. Messrs. H. and E. J. Dale sell a head and body-rest (Fig. 34) for £1 8s. 6d., or without the body rest, £1.

A very neat and cheap form for attaching to the chair, as shown in Fig. 35, is made by Messrs. Lejeune and Perken, and is sold at 7s. 6d. at the dealer's.

A plain background, which need not measure more than 4 feet by 5 feet, either very light (if for "vignette" portraits) or painted a dark shade; the latter gives the richest pictures and is the best to use for general work; an intermediate tint should not be chosen, or, there being no contrast to the face and hands, a tame and flat picture will be produced; while, on the other hand, a white background makes the face look unnaturally dark. Most pleasing effects in light and shade may be obtained by using a concave or conical background; the former can be made out of papier-mache, and fixed to a stand in such a manner that they can be raised or lowered to suit the height of the sitter; a conical background may be made out of a large circular piece of cardboard having a V-shaped piece cut out from the centre to the outside, so as to form, when the edges are joined, a circle about four feet diameter, and a cone from 18 to 20 inches in height from tip to base. When the mouth of this cone is placed behind the sitter's head so that the lens is looking into its interior, the contrasts of light and shade give very pleasing and useful effects, as, owing to the concave or conical form of the background, the shadows on the sitter's face are relieved by the high lights that will appear on that portion of the background, while the high lights on the sitter's face are, in like manner, contrasted by the deep shadows on the background.

A very simple, but efficient reflector, which may be made to work equally as well as a much more expensive one, may be easily contrived by covering a large clothes-horse or folding-screen with a white sheet, or even several newspapers. If nothing better be at hand, an ordinary bed-room mirror may be used.

The camera, lens, and stand can be the same as used for landscape, a rectilinear being the best form of lens for portraiture in addition to landscape work; portrait lenses are very expensive, a Dallmeyer or Ross for cabinets would cost £15 or £18, but good lenses of French manufacture can be obtained for £3 or £4; unless, however, the amateur intends to make portraiture his hobby, a portrait lens is not necessary. A studio stand will be found to be a very useful substitute for the ordinary tripod, which will be found very awkward to manipulate in a small room; Fig. 36 illustrates a light stand in white pine, which Messrs. Dale supply at 12s.

If there is more than one window in the room, the others should be covered up, as "false lights" are often produced when the light enters from two distant windows.

The sitter must not be too near the window, or the side light will be too strong, the further away the subject is from the window, the softer and more delicate will be the lighting, but at the same time, the intensity of the light will be proportionately decreased. A happy medium should therefore be secured, and this may easily be done by altering the position until the most favourable light is discovered. Very few bay windows face north—the majority look south or south-east; we will, therefore, take as an example a window having a southerly aspect.

To go through the operation of taking a head and bust portrait, will, I think, be the best way of dealing with the various stages of lighting and posing, and to make my description more clear, I give a rough plan (Fig. 37) of a small room showing the bay window, and the positions of background, sitter, reflector and camera. The sitter should always be sat opposite the source of light; for an afternoon or mid-day light the sitter should be placed near the east window, for a morning light at the opposite side. A low-backed chair is placed about A, but if the light is very intense, it may with advantage be placed a few feet further into the interior of the room. The camera may be placed anywhere on the dotted line, from B′ to B′′′′, but the sitter's face must be arranged accordingly. For a three quarter face (showing one side of the face and a small portion of the other) lighted in the usual manner, the best position for the camera is, perhaps, about B′′, for a profile picture about B′, at B′′′ for a full face, and B′′′′ for Rembrandtesque effect. The camera stand should be adjusted so that the lens is level with the sitter's eyes. For a three-quarter inch face with the camera at B′′, the reflector should be placed as shown at C, D, E; the shadow on the side of the face may be increased or decreased to almost any extent by simply moving the reflector nearer or further away from the sitter—in fact, if placed as close as possible to the sitter's chair without being included in the picture, the reflected light will be equal to the direct light falling on the other side of the face, and coming from the window.

The camera is fixed at a proper distance from the chair, which is roughly brought into focus on the ground glass, the reflector is placed near the chair so that it may be quickly adjusted, and everything that will be required during the operation placed conveniently to hand, so that walking about the room and opening and shutting doors may be avoided before the sitter makes his appearance, as all these things tend to annoy him and increase his nervousness.

A few words respecting the sitter's dress will not be out of place here. A portrait, to be life-like and truthful, should present the subject in a costume he or she is accustomed to wear in every day life, and not "fixed for taking," as the Yankees say. Simplicity in the dress is the chief point productive of an

artistic portrait; the costume should be of the quietest possible kind, without violent contrasts of colour or ridiculous puffs, frills and what not, which only have the effect of making the figure unshapely; jewellery should be very sparingly used, and beyond the scarf-pin and watch-guard of the male, and the brooch or small locket of the gentler sex, there is no reason why it should be permitted to form part of the picture—it rarely takes well and (as with an excess of accessories in a full-length) only serves to draw the eye from the principal object: the sitter's face. The style in which the hair is accustomed to be worn should never be changed, yet very few ladies can resist the temptation to "do up" their hair after the latest style for the occasion, although they may never have worn it in that particular fashion, which may be wholly unsuited to their general appearance, before. Above all, grease or hair-oil should not be applied, and would be used much less if the sitter knew that from its glossy appearance, a bald or grey effect is produced wherever the light falls upon the head; neither should an excess of water be used to keep the hair straight, as it causes it to assume a stiff and unnatural appearance.

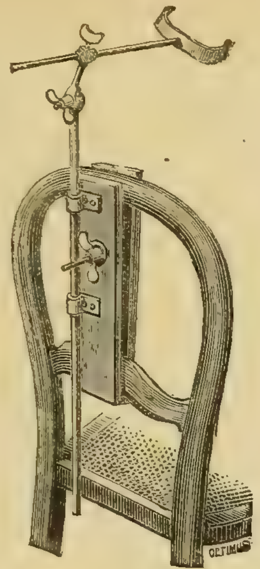


FIG. 35.—HEAD-REST FOR CHAIR.

FIG. 34.—HEAD AND BODY REST.

The colour and material of the dress should be regarded as a matter of no little importance; the colour should be one which will suit the complexion; for instance, a white or light blue dress worn by a brunette, would produce a complexion unflatteringly like a negro's; it should be of soft material that will drape well, and no dress looks better in a photo than one made of velvet or cloth with a *little* cream or coffee-coloured lace round the neck. The colour of a gentleman's dress is not so important as that of a lady, but large checks and very light material should not be worn; dark blue serge takes well. Messrs. Piper and Carter publish a useful little tractate containing "Hints to Sitters," per post two stamps, which the amateur portraitist would do well to purchase.

The sitter is now placed in a comfortable chair, which should have a back sufficiently low as not to be seen protruding above the shoulders. The body should almost face the camera, but the head must be turned towards B‴, the hands, although not included in the picture, should be placed well to each side so as to throw the shoulders back, and prevent a narrow-chested appearance; the body should be erect, neither leaning back nor forward, the former causes the head to be out of proportion to the size of the body, while the latter gives a weak and undignified appearance. So many different colours of blinds are used for windows that it renders it almost impossible to say exactly how they must be used, the most useful are the common white cotton blinds, which serve to diffuse the light, but do not cut off its power to any great extent; venetian blinds are very troublesome, and are of little use.

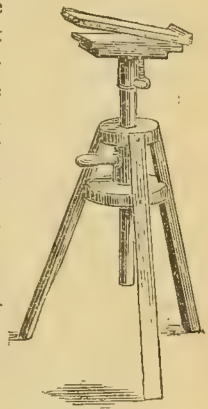


FIG. 36.—CAMERA STAND FOR INDOORS.

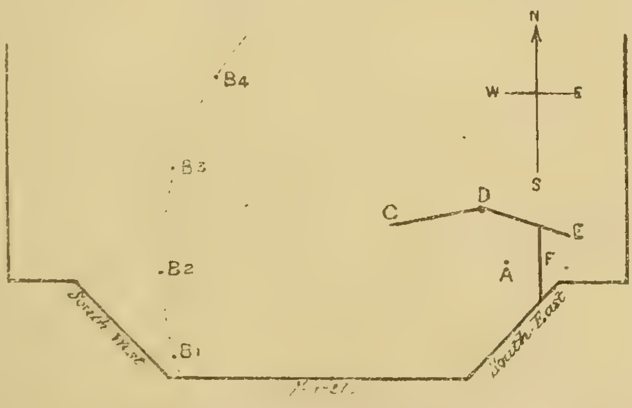


FIG. 37.—ARRANGEMENT OF BACKGROUND, SITTER, REFLECTOR, AND CAMERA. A, Sitter; B 1, B 2, B 3, B 4, Positions of Camera; C D E, Reflector; F, Background.

The south-eastern blind should be drawn quite down, while the other two must be regulated according to the direction and quality of the light, but neither should be drawn to the bottom unless the sun enters the room.

When the light side of the face has been properly lighted, the screen may be placed in such a position as to reflect a strong light,

though not quite so intense on the shadow side; it must, at the same time be remembered that the contrast is much greater in the finished picture than it appears to the eye on the ground glass. A newspaper or other white material should be placed on the sitter's knees to reflect the light under the chin and nose.

Lastly, the sitter is required to turn his eyes, but not his head, to some dark object in the interior of the room, and placed rather nearer the camera than the direction of the head, or he will appear to be looking out of his eye corners. There are two reasons for having a dark object to look at: the first is that if the exposure be long a light or glittering article is very irritable to the eyes, and may cause the sitter to move them from their first position during exposure; second, looking at a dark object enlarges the pupil, a light one causes it to contract. Now, and not till now, the head-rest may be gently applied to the head behind the ears, not the head to the rest.

Return to the camera, and quickly, but quietly, bring the image to the proper size and position on the ground glass by moving the camera as required, and finally focus for the eyes as sharp as possible. The size of the image should be such that the whole of the shoulders, from tip to tip, are included in the *finished* picture when cut down for mounting.

Insert the stop—if a view lens, the largest should be used—cap the lens, see that the dark slide is well shielded from the light when inserted and the shutter withdrawn, warn the sitter and expose, giving from twelve to sixty seconds, according to light, etc.

Develope as usual, and if the plate is over-exposed, or one side of the face too much in shadow, breathe through a small paper tube upon the place that requires greater density; the effect will be a wonderful improvement, and may save a lot of trouble with intensification afterwards. One more hint: don't show proofs to the sitter until the negative has been touched up, or his opinion may not be flattering to your photographic abilities.

(*To be continued.*)

NOTES ON NOVELTIES.

By THE EDITOR.

10. "THE FIRSTBORN."

10 "THE FIRSTBORN."—The demand on my space this month for "Amateurs in Council," tends to restrict my "Notes on Novelties" to the scanty measure of half a page, and I must offer my best apologies to all whose various wares and productions I am unable to notice now, for keeping them waiting until next month. The first thing that I am bound to deal with now is the new mezzotint engraving very recently produced, as published by Mr. George Rees, "*Savoy House*," 115, *Strand, London, W.C.*—an engraving whose excellence of execution is on a par with the interest of the subject, and an admirable rendering in black and white of the conception and colouring of the artist, Mr. G. Hillyard Swinstead, whose picture, No. 602, formed a noteworthy object in the Exhibition of the Royal Academy this year, and attracted considerable attention. The engraving, which is by Mr. S. Arlent Edwards, measures 25½ inches by 19½ inches, without reckoning the margin, which is an ample one of about 6 or 8 inches in width, so that those who may be inclined to purchase it may readily judge of its size when suitably and handsomely framed, a requisite addition which Mr. Rees will carry out to perfection, sending estimates to any one who may wish it, for any particular kind of frame that may be desired. The price for Prints is 21s., for Artist's Proofs, which are being rapidly exhausted, 275 only having been taken, £5 5s. I can warmly recommend the engraving as an addition to the adornments of the home for the coming Christmas, or as an appropriate wedding present—a forecast, if I may be permitted to say so, of a coming event, which is welcomed with pride and joy by all to whom the pleasure of looking on "The Firstborn" is permitted. The subject of the picture is one of home life, and represents the interior of the living room of an English farm-house, or an English emigrant's home in one of our distant colonies, for it may be taken to apply equally well to either. In the centre of the picture is represented a young mother, strong, healthy, and if not absolutely beautiful, with a pleasing, good-tempered expression of countenance, who we may be sure will be always ready to promote her husband's plans, meet his wishes, and do her best to second his efforts for the advancement of himself and his family in life. On her knees she balances and supports the "firstborn," a merry, happy child, who stretches out his little arms to the puppy which the young father holds towards the boy, while leaning against a massive table intended rather for use than for show. The group is completed by a colley seated on the paved floor at the father's feet with head upturned towards the puppy.

The happy, joyous family party are in front of the kitchen fire, and the right foot of the mother rests on the edge of a rough mat that does duty as a hearthrug, and whose colouring is relieved by a dinner plate placed on the corner, and evidently put there for the benefit of the colley, who has cleared its contents. The background is formed by the wall of the room, and various accessories fixed to and suspended on it, while to the left is shown a low casement window with a roomy seat before it, under which is thrust a rough and evidently home-made wooden cradle. Many an amateur and reader of AMATEUR WORK is given, as I very well know, to picture-frame making as a pastime, and, if any of them are in want of a first-class engraving representing an episode in married life, which cannot fail to appeal to the best feelings of those who have entered the "holy estate," or of those, even, who are contemplating entrance at no distant period, they cannot do better than obtain a copy of this picture, as a desirable subject on which to exercise their skill. "The Firstborn," I may add, is a companion to "The First Step," so if a companion plate is wanted there will be no difficulty in obtaining one that is most appropriate.

AMATEURS IN COUNCIL.

For "Instructions to Contributors and Correspondents," see page 44 of this Volume, or Part 60, page 44.

Address Wanted.

HARE'S FOOT.—I have written to you at the address given in your letter of Oct. 4, in which you propose to take up a certain subject, and explain why you have adopted the *nom-de-plume* that heads this paragraph. My letter, however, has come back to me through the dead letter office. Possibly you have removed to another address; if so, kindly furnish me with it, with as little delay as possible.—ED.

Practical Scene Painting for Amateurs.

ERRATUM.—By one of those unfortunate wanderings from the right way, which it is difficult to understand and account for, the illustrations of the Proscenium Wings, Figs. 87 and 87A, page 24 of this volume, have been wrongly placed, and are upside down. Reverse the drawings, and place that on the right hand of the page to the left, and *vice versa*, and each will answer to its inscription as the inscriptions now stand. To remedy this as far as possible, the publishers have had cancel pages printed, and will supply them to any readers and subscribers who may care to make application for them.—ED.

Sign-Painting and Letter-Writing.

S. P. L.—Mr. H. L. Benwell has this subject in hand, and it will be commenced as soon as his papers on "Practical Scene-Painting for Amateurs" are brought to a conclusion.

Manufacture of Soap and Candles.

J. S. B.—Candles are made in moulds or by dipping. If in moulds, the wick is inserted in the centre of the mould, so as to form a central core, and the material of which the candle is to be formed is poured into the mould and allowed to harden round the wick. If by dipping, wicks of cotton, suitably suspended, are dipped in melted tallow and then removed to allow the tallow to solidify; the process being repeated until the candle is thick enough. With regard to a work on the manufacture of soap, there is Morfit's "Practical Treatise on the Manufacture of Soaps," published by Trubner and Co., *Ludgate Hill, E.C.*, at £2 12s. 6d, but I think you may gather all the information you require from the three books by Mr. W. Menzies, namely, "Practical Directions for Softening Water, Making Soap," etc., "The Laundry Guide," and "New Methods of Wool Washing," etc, published at 6d. each by Messrs. McCorquodale, Limited, *Newton-le-Willows, Lancashire*, and *London*, and noticed in "Notes on Novelties," page 43 of this Volume.

Painting Dog Carts.

W. L. (*Golborne*).—The word ciss, pronounced *cess* by painters, means that varnish when put upon any oil or varnish colour without having previously been flatted or washed, will not adhere to it, but runs up and forms itself into beads. If we have varnished anything which has cissed, breathe upon the work and varnish over again and it will afterwards be all right. Varnish cisses in a few minutes after it is laid on the work.

Sale and Exchange Department.

CO. CAVAN writes:—"I beg to call your attention to one thing in AMATEUR WORK which I fear will discourage a great lot of subscribers. I am acquainted with dozens, and all are of the same opinion. This one thing is—charging for sale, purchase, and exchange notices. The charge surely is small, but it will not compensate for all who will drop off on that account. Look at the notices in October, 1885, also in October, 1886, and you will see a great change—greater, I think, than you expected. This charging has disappointed a great lot, and may disappoint yourself in the end, as a good many take another magazine which does not charge for the like. It is losing the ship for the half-pennyworth of tar." [People, generally speaking, do not regard at much value that which they can get for nothing. The charge, which you allow is small, acts only as a deterrent to those who will advertise indiscriminately when they can do it for nothing. No one who has anything worth selling to sell, or is really in want of any special article, will grudge the small sum charged for the insertion of his notice. The result has been exactly what I anticipated, and I can assure you I am in no way disappointed, though I am sorry for the "dozens" of your acquaintance who, with yourself, find fault with my procedure. I am glad, however, to find that AMATEUR WORK is (or was) so popular in Ireland. Kindly supply me with the name of the other magazine which does not charge for the like, as it and I are strangers to each other at present. The ship, I am glad to say, at present shows no sign of being unseaworthy for want of application of a ha'porth of tar in the shape of gratis advertisements. The notices free of charge have served their purpose, and now the system is advisedly abandoned.—ED.]

Metal Inlaying.

MESSRS. BENHAM AND FROUD, LIMITED, General Metal Workers, and Importers of Foreign Goods, Chandos Metal Works, *Chandos Street, Strand, W.C.*, write:—"We notice an article in your present Number (*i.e.*, Part 59, October, 1886) in which metal inlaying is referred to. We may be allowed to mention that we have completed and patented fully a process for inlaying metals in metals, one item of which involves the use of cementing material." [This will be interesting to many readers to whom Messrs. Benham and Froud, would doubtless, explain the process if applied to at their works as above.—ED.]

Harmonicon.

W. C. C.—The instrument to which you refer is known as the Harmonicon. The most common form is that of a tray or box of wood, with tapes tightly stretched from end to end across the open top, which are attached, and which sustain pieces of glass and metal graduated in size so as to give forth successive notes when struck with a stick, having at the end a piece of cork or some similar substance. You can buy one in any toy shop for a shilling, and an examination of this would afford hints and suggestions for making a more powerful instrument. The portions of the top to which the glass or metal does not extend are covered in with thin wood, and this adds to the resonance of the instrument. A Harmonicon *may* be made of wood, but you would not get any great volume of sound from it.

MUSICUS.—I do not know "Woodhead, the Musical Marvel." You ask how his "instrument is made and played," and you immediately proceed to describe it as "a wooden tray about three feet long by two feet wide, containing a number of ordinary looking gill glasses, perhaps about thirty in number," and say that the Marvel "plays it by rubbing the edges of the glasses with his fingers." Thus you leave me nothing to say about making and playing, and all that I need tell you is that it is a form of Harmonicon, and that the glasses are filled with water sufficiently high to cause them to give forth the necessary note when rubbed with the tips of the fingers, which should be moistened.

Electro-Motor.

A NEW SUBSCRIBER.—As so many subscribers ask for information on this subject, I think it desirable to write and illustrate an article on "How to make a Small Electro-Motor."—G. E.

Silver and Brass Plating.

C. B. B. H. (*Ballyhannis*).—Iron rods and railings may be silver plated or brass plated by either one of two processes. The rods may be covered with brass leaf or silver leaf by the fire process, *i.e.*, by soldering the leaf to the rods; or, by the electro-process. (1) *Fire-plating.*—Clean the rods and free them entirely from all rust, grease, and dirt. Cover them with a solution of copper sulphate (blue stone) which will deposit a thin film of copper over all the rods. Wash and dry this film, and tin it perfectly with common solder. Cut the silver or brass foil into strips just wide enough to go round the rods, and solder these to the rods by sweating them on to the tinned film of copper. (2) *Electro Silver-plating.*—Cleanse the rods as before directed, then immerse them in a hot solution of caustic soda. Rinse in water and transfer to an alkaline copper solution, from which a thin film must be deposited by current from a powerful battery. Again rinse in water, quick with mercury nitrate, rinse in water, and transfer to silver-plating solution, from which the requisite film of silver must be deposited. After this the rods must be rinsed, dried, and polished. (3) *Electro-brassing.*—Prepare the rods as for silver-plating, and deposit a film of brass from an electro-brassing solution. Full particulars cannot be given in this column, but I shall be pleased to write a few articles on the subject if required.—G. E.

Zilles' Metal Plates for Fretwork.

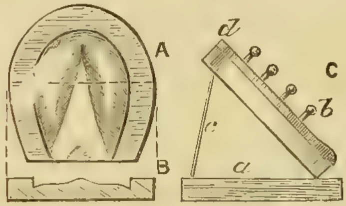
Mr. Henry Zilles (9, *South Street, Finsbury*) writes :—"As some amateurs seem to have had difficulties in transferring designs on my metal plates for fretwork of zinc, by way of the blue or red tracing paper, owing to the lines becoming obliterated on polished side, it will interest them no doubt to know a better way of doing so. It is as follows : Pour a solution of shellac (good quantity) on polished side, and rub it with your finger (not a brush) all over it, then let the superfluous shellac drip into the bottle again from one corner; and when surface is dry, stick the design on it with ordinary paste, which, if you should use tissue paper for design, has to be put on plate and not on back of design, as otherwise it would shrink. Cut out the outlines first, and if these should be straight, use a pair of tinman's snips. Put a little oil to the drill bit when boring holes, as well as to saw when sawing it, with a brush, and let the saw be very tight in frame. Saw slowly and quietly, as otherwise saw will break. In order to get rid of paper and shellac surface when design is cut out, put plate in warm water and wash off the adhesion, after which plate is to be dried carefully with a towel; then pour some common spirit in a saucer, and with the help of an old, not too soft, tooth brush, you will be able to take off shellac easily. It is advisable to do this in the open air, or at least near an open window, to prevent becoming intoxicated through the inhalation of spirit. You can also fasten the tissue paper on polished side with a good kind of glue and an equal quantity of glycerine, which will keep the glue damp and prevents design coming off; and if the oiling of saws should be found a tedious performance, pour a moderate quantity of oil on adhered tissue paper, just before sawing plate with No. 0 saws instead of finer ones. As pencil tracings cannot be seen well on oiled paper, use ink instead.

Overhead Motion.

Grooved Barrel writes to ask how an overhead motion "is used," and says that he has the back vols. of Amateur Work. "I have looked through the Indexes and find several articles treating on the Overhead. For instance, in Vol. III., p. 518, there is an article on "Details for an Overhead;" this is a complete form. On page 420 of Vol. IV., "How I made my Overhead;" also on page 468 of Vol. V., "A Cheap Overhead." The question is, however, not how the overhead is made, but how it is used; perhaps the querist will find what he wants on page 292 of Vol. II., since there he will see the bands and the driller fixed in the slide-rest. If G. B. will kindly say more exactly what it is he requires to know, which he cannot find in the articles named, I will try to help him again. Meanwhile, I may say as to the uses of overheads in general, that, just as in turning, the work revolves so that the fixed tool produces circular work; so by means of the overhead, the motion of the flywheel can be communicated to revolving tools or cutters whilst the work is held still, so that slots, or grooves, and flutes (as on a column) can be cut out; also flat work such as the flat sides of a nut, or the square sides of the base of a pillar, and such like work, can be done. But note that an overhead would be of no use without a division plate and index-peg, or other device to hold the work and fix it in position. Besides this, it is evident that an overhead would be of no use without the rotary tools, drills, etc., which it is intended to drive. The first of these, and a most useful, would probably be a drilling spindle, which costs from the best makers £3, but can be obtained for about 30s.; these must be well made, as they run at a great speed. Then, next, would probably be required a vertical and horizontal cutter for doing what is called basket-work, or, if made strongly, for cutting the teeth in small brass wheels, etc. With these two additions, though so simple, the powers of a lathe are greatly increased. An overhead is then a very valuable addition if used in connection with a division-plate and index, and it has so many uses besides those named that it would require a small book to describe them all.—F. A. M.

Pen and Pencil Rack.

J. S. B. writes:—"I send you another hint on the utilisation of waste materials



PEN AND PENCIL RACK.

A, Plan; B, Section; C, Side Elevation; *a*, Wood Block; *b*, Pegs or Nails; *c*, Wire Support; *d*, Horse-shoe.

copied from the *New York Farmer*: Take a piece of wood and carve it like the bottom of a horse's hoof, then take an old horse-shoe, knock out the nails, drill a hole on the underside of the middle of the bend, fasten in a piece of wire as a support, sticking the other end of the wire in another piece of wood, which forms a stand for the whole. Put brass-headed nails or wood pegs into the holes in the shoe: paint or varnish, and it is complete." [I give your "hint," but the rack thus made would be cumbersome and far from attractive, as an old horse-shoe is not a desirable ornament for a writing-table. Old horse-shoes are better utilised by welding two together in order to do duty again as a new shoe, and a pen and pencil rack in the form of a horse-shoe—by no means a novel idea—could be easily carved out of wood alone, or formed of metal, so as to present a far prettier article for the table than its prototype.—Ed.]

Damp Walls.

Eliziam writes:—"The walls of my drawing-room are very damp, a substance like soda oozes out of the walls destroying the paper. I have tried several reputed remedies but failed. Any information as to a real cure will oblige." [I wish you had named the reputed remedies you have tried, and stated how long the house has been built. There seems to be an afflorescence from the plastering, which indicates badly prepared material. I should be inclined to hack off all the plastering until the wall itself is exposed to view, and then renew with a coating of Portland cement faced with Keen's Cement.—Ed.]

Bergeron's "Manuel du Tourneur."

Tasmanian.—I gather on inquiry that Bergeron's "Manuel du Tourneur" was first published in 1816, in two volumes for £4. It is now out of print. It may be possible to obtain a second-hand copy by advertising your want in "The Bookseller," "Publisher's Circular," "English Mechanic," "Bazaar," etc., and this Magazine.

Designs for Wall Brackets.

R. G. W. (*Maidstone*).—You will soon find some good designs for wall brackets to be covered with velvet or plush in Vol. IV., page 110 (in Part 38). These brackets can also be made in fancy woods. There is a nice bracket, in turned work, in Vol. III., page 79 (in Part 25). All back parts of this Magazine are always on sale, and there should be no difficulty in procuring them through any bookseller.

Cement for Fixing Lamps, etc.

E. P. (*Midleton, Co. Cork*) remarks in reference to recipe by H. A. H (*Manitoba*), Vol. V., page 558:—If powdered Bath-brick is added to the alum it will be a much stronger cement. Melt the alum and Bath-brick together (the quantity of the latter is immaterial). When the ingredient boils up apply at once while hot, as it cools and sets quickly. It is equally useful for fastening any metal to wood, such as ferrules for pipes, brass plates for top of desks, etc., to avoid use of screws.

Mount Cutting.

H. D. G.—You will find all the information you require about Mount Cutting and the tools and materials required in "Mount Cutting, and All About It," by An Old Hand, which appeared in Vol. IV. of Amateur Work (or in Parts 46 and 47). You can purchase everything you require in the way of materials and tools of Mr. Gus Rochfort, 29, *Basinghall Street, London, E.C.*

A Work on Photography Gratis.

G. P. A. (*York*).—The pamphlet to which you refer in your letter is "A Photograph and How to Take it," by "One who Knows." It contains valuable directions for procedure in taking photographs, and the price list of Mr. E. G. Wood, 74, *Cheapside, E.C.*, and Messrs. Horne, Thornthwaite and Wood, 416, *Strand, W.C.*, by whom it is supplied gratis.

Case for Ferns.

Linnæus.—You will find instructions for making ferneries of all kinds in Vols. II. and III. of Amateur Work, or to be more particular, in Parts 14, 16, 21, 23, 28, and 32, in the series of papers entitled "Ferneries: How to Make Them and Manage Them," by Donald Bede. If the ferneries and cases described therein do not exactly meet your requirements, kindly write again and describe your special want.

Bogus Advertisements.

T. B. (*Chard*).—I am obliged to you for your suggestion, but purchasers can easily take care of themselves and their money by refraining from sending the latter before they have satisfied themselves as to the value of the articles offered for sale by correspondence or actual inspection. If an advertiser wilfully gives a false description of an article to anyone by letter, and therefore induces the purchaser to buy what is not according to description, it seems to me very much like getting money under false pretences, and the buyer has his remedy.

Gold Printing.

AMATEUR PRINTER asks:—Can you or any of your readers inform me how printing in *gold* is done? I have printed a number of cards in blue ink, and to brighten them up I want to surround the blue type with a fancy border in gold. How is the *gold* ink prepared? Any information on the subject will much oblige. [To prepare a medium for printing in gold, buy a small quantity of chrome, which mix (after grinding into powder) with a little gold size, just sufficient to make all to the consistency of printing ink. Prepare a clean roller, not too fresh, and roll the type or border (which must be clean) with the chrome mixture, as if ordinary ink. Then with a small piece of wadding rub gold bronze very lightly over the printing before it is dry. Let the gold remain for an hour before dusting off with a piece of clean wool. All previous printing must be perfectly dry before the gold printing is done or it will take the gold on it.—ED.]

The Praxinoscope.

W. J. P.—In reply to your three questions on this instrument (1) The pictures are not pasted or otherwise fixed on the tin case. They are printed—or drawn if you make them for yourself—on strips of paper as shown in Fig 17, page 4 of this volume. It is better for their preservation, and also to retain them in the proper position against the inner surface of the tin cylinder, to mount them on slips of cartridge paper of corresponding size. The number of changes of position shown in any picture varies from about ten to fifteen. All that is necessary is that a sufficient number of changes should be shown to afford the desired effect of apparent motion during the revolution of the cylinder. (2) The width of the pieces of silvered glass should be 1⅝ inch and not ⅝ inch, as stated by a clerical error in page 5, col. 1, line 8. These errors frequently arise by the dropping out of type in the final preparation of pages for the machine after they have passed through the hands of reader and editor. (3) With regard to the revolving contrivance shown in Fig. 15, the band shown on the vertical grooved wheel attached to the pillar or pedestal on which the cylinder revolves is crossed, and passed round the groove of another wheel, which is horizontal, and fixed to the bottom of the cylinder. When the vertical wheel is turned, motion is imparted to the cylinder by means of the band or cord, in a manner similar to that in which the roller of a blind is turned by the blind-cord. If the grooved wheels are of the same size the cylinder will turn round once for every revolution of the vertical wheel.

Nailing up Picture Frames.

ONLY AN AMATEUR.—I do not know any mouldings for picture frames that are gilt on the back. Gilding on the back and edge would be simply a waste of gold leaf. The edge and back are usually coloured, and frequently the back is not touched; look at your mouldings again. This being the case you cannot "damage the gilt on the back of moulding" by nailing the pieces together. I am also at a loss to understand why you should touch the back at all when nailing up, because the nails are driven through the edge. By the "edge" of the frame, please understand the surface of the frame which is perpendicular to the surface of the wall when the picture is placed against it. The only way to avoid damaging the frame when nailing up is to bore holes in the frame with a fine bradawl, to receive the points of the nails, and then to drive them in carefully with a light hammer.

Cabinet in Fretwork.

MELTONESE.—Your request for a design for "an elegant Combination Cabinet in fretwork," after the style of the Smoker's Companion shall be noted. I may say, however, that I have some beautiful designs in fretwork that will appear shortly, and that an inspection of the designs published by Mr. G. Busschots, *Liverpool*; Messrs. Harger Bros., *Settle, Yorkshire*; Messrs. J. H. Skinner and Co., *East Dereham, Norfolk*; and Mr. Henry Zilles, 9, *South Street, Finsbury, London, E.C.*, would not, I think, fail to furnish you with patterns for many useful and beautiful pieces of furniture which you might make with advantage.

Imitation Stained Glass.

MELTONESE.—Many articles and series of articles on imitation of stained glass and painting on glass have appeared in AMATEUR WORK, for example, "Glass Painting and Decorative Glazing," in Vol. V., which you have, as you have been a subscriber for two years; and "Byssophanie: a Cheap Substitute for Stained Glass," which appeared in Vol. III. (Parts 24, 25, and 26). In this all needful information is given about the tissue, the colours used, etc., and the articles are accompanied by some good and appropriate designs. Further, you will find the "Patent Glacier," sold by Messrs. Perry and Co., Limited, 18, 19, and 20, *Holborn Viaduct, London, E.C.*, and advertised in this Magazine, a most desirable and easily applied substitute for stained glass; and, lastly, the sheets of gelatine, used for wrapping up sweetmeats and in the manufacture of cracker bonbons, may be cut into various shapes and patterns and applied to glass, making a very beautiful and brilliant imitation of the genuine article.

Silvering Mirrors.

H. G.—In reply to your inquiry for instructions for silvering "the convex side of a glass concave mirror, I may say that the glass can be safely and easily silvered by the process described in my papers on 'The Reflecting Telescope: its Construction and Manufacture,' Vol. V., page 491 (or Part 58). The silver being on the back of the mirror may be coated with varnish to preserve it. Of course, the glass must be removed from the metal case. It is imperative that no metal should touch the silvering solution."—E. J. F.

Lenses for Telescope.

J. M. (*Sunderland*).—For the telescope described in Vol. III., page 393 (or Part 32), the following lenses are required:—The object lens (one single lens) and the eyepiece of two lenses. For the method of forming eye-pieces see current issue, where a completed little telescope is also shown in section. You should buy an achromatic object glass if you can. Read the papers on "The Reflecting Telescope: its Construction and Manufacture," Vol. V. and the current volume; they will be helpful to you.—E. J. F.

The Woodbury Tissue.

J. H. Z. writes:—"Allow me to express my admiration of the new tissue for photography; it does all that is required, and with little or no trouble. Amateur photographers first working with it may find bubbles; but if they turn over the tissue from time to time during development and use a small camel's hair mop over the tissue, all will break. Again, if the tissue is used as a positive, and developed rather deeply, it makes a beautiful transparency mounted between two pieces of plain glass. For window decoration I cannot speak too highly of it.

Modification of Slide-Rest for Planing and Shaping.

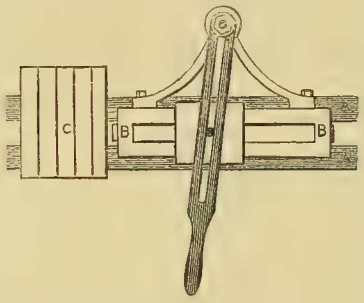
F. A. M. writes to A. F. C. (*Bombay*).—"I readily respond to your invitation, because I have got a planing attachment and feel an interest in the subject. I rather admire your plan, and think it better than my own; it is a pity your sketch was put in upside down. My plan is the well known 'Northcote' arm; the upper part of the slide-rest is removed and fixed upon the arm, whilst a planing table takes the place of the rest. This has the disadvantage of requiring about ten minutes to fix up. Yours would be fixed up in two or three minutes, and therefore I like it better. The bed on which the work is fixed is kept well down, which is good and looks firm. The radical defect in both these plans in which the work slides on the lathe-bed, is, tha if much work were done the bed would certainly be badly worn. The lathe-bed is sure to get most worn by turning, near the headstock: if not much planing is to be done, and if you take care when planing to use the right hand end of the lathe-bed, you may even do good and equalize the wear. If, however, you are likely to have *much* planing to do, it would be far better to get a hand planer; and I see the Britannia Company have advertised one at £15, which is a very low price. You would require to have the planing-arm very stout and rigid, and there should be a flange and circular T slot behind the tool

box slide, to enable you to feed down at an angle. You could rock the saddle to and fro to give the cut, but I have found this a very awkward way, and should strongly advise your fitting a lever to work horizontally; you might have it made to give a variable stroke and leverage, say two to one for brass and four to one for iron. You would be cramped for height if your lathe is only 5 inch centres; the planer-bed could hardly be less than 2¼ inches nigh; and the tool-plate will be about three-quarters of an inch below the centre, so that 3 inches are taken up. I think you should have 3 or 4 inches clear under the tool slide when the latter is raised, and I would bend the planer-arm up an inch or two to get this if required Since I got my planer I have added a backshaft, and now I do not care to rub the saddle up and down, and wish I had a separate machine. You will probably come to wish the same, though, perhaps, not quite so soon as I did, as your device seems better than mine. Lee's machine does not suit my notions.

Goldsmith writes in comment on the modification proposed by A. F. C. (*Bombay*), Vol. V., page 558:—"I hope I may not damp this inventor's ardour when I say that his method in its entirety will not work, for the motion given by the screw of the slide will be far too slow and constrained to give a good 'swishing' stroke on the metal to be planed; but it may be made to answer tolerably by providing a slotted lever (as in the annexed diagram) to work the slide, pivoted over the bed, and produced to about 8 inches towards the front of the lathe, as shown in the sketch. And to allow of the motion, the screw of the top slide must be removed entirely; but I doubt whether it will be worth while to go to all the trouble to make this. I may mention that there is a patented arrangement now in the hands of The Britannia Company which will produce much better work, and will plane 80 square inches on a 3 foot 4 inch bed. This patent will shortly be before the public, and I am sure the Company will be most happy to give all particulars, and send a photo and prices of this most simple and efficacious arrangement to any applicants." [The patented arrangement to which Goldsmith refers is Balck's Patent Lathe Planer, on which a paper by the Rev. James Lukin will shortly appear.—Ed.]

Goldsmith writes further on this subject:—

"As the preceding remarks on this arrangement could not appear in Part 60 as intended, I may be permitted to go into the whole matter at greater length, but, as the question is put to Olla Podrida among others, I hope I may be pardoned for taking up the subject, as I have lately had some experience in it. To begin with, I should say that the first essential of a planer, whether as an attachment in a separate machine, is its absolute rigidity under the strain of a cut. It must also have a considerable range of movement vertically in order to take articles of various heights, as to enable a cut to be taken in the bottom of a groove. The feed should be automatic, for unless it be, the work will be very irregular; and the power should be conveniently applied. The greatest fault I can see in A. F. C.'s suggestion is, that it would fail in a notable manner in rigidity, more especially when the cut is of any length, for the bar which holds the cutter head could not easily be constructed of sufficient size to be rigid, but if it could, its size would prevent it being fixed in the manner he suggests; nor would the sliding surface utilize to direct the movement (*i.e.*, the top slide of the rest) be sufficiently large to resist the strain of removing the metal to be planed off. The tool if it *would* move would dig in viciously, and break and spoil the surface. There is also not sufficient vertical movement as shown, although, perhaps, that would not matter much if the rigidity were right; neither is there any arrangement for a slowing or quadrant motion.



SLOTTED LEVER ON SLIDE REST.
A, Lathe Bed; B, Slide Rest; C, Planing Table.

This also could be arranged, other things being right. I do not see either that an automatic feed could be easily arranged, and without that a planer is at a very great disadvantage. As to the application of the power to move the tool over the mark, my short, first note will show how that might be arranged; but, as suggested by A. F. C., it is a practical impossibility, for the labour of working the screw backwards and forwards would be very great, and would quickly wear the screw out. I should be the last to discourage anyone, amateur or otherwise, but I feel sure that it would be only labour and money thrown away to construct this arrangement; but I shall be most happy to help A. F. C. in the matter if he will communicate with me.—W. B.

E. J. S. (*Westbury-on-Trym*) writes to A. F. C. (*Bombay*):—"I think that, except for the lightest cuts, the modification of slide-rest planer sketched would prove very unsatisfactory, the chief objections being that in order to obtain a stroke at all the shank of tool-holder must be comparatively long and unsupported for a sufficient length to render elasticity a certainty, and it is throwing unfair work on the female slide to which the tool-holder is attached, which for this purpose should exceed the length of the male slide, at least by the length of the stroke. As sketched these two slides would have to be adjusted together so closely that the tool could not be advanced without throwing some excessive work on the traversing screw operating it, and this screw being but of small size would be likely, I think, to soon show signs of wear, although subject only to the occasional requirements of an amateur, the surfacing slide, too, would have to be adjusted quite tightly to prevent the slightest give, or untrue work will result. I am a little surprised at the absence from sketch of a rack and pinion for quickly traversing the saddle to any part of the bed, as this means of giving motion to the tool would, in my opinion, be preferable to that by the traversing screw of slide-rest, or a lever might be rigged up pivoted behind the bed, and joined to the saddle by a connecting rod, and if the distance from handle to connecting rod was three or four times that from the latter to the pivot, probably ample power would result for light cuts, or the lever might go down between the bed and be pivoted to or between the webs connecting the two sides of the bed. But inasmuch as a new saddle to hold the planer bed, is necessary with this design, why not go in for an upright one, as sketched by O. J. L. in the 'English Mechanic,' Vol. XLII., No. 1086, for January 15th last, with or without the modifications suggested by E. B. F., and according to letter 25425 in the 'English Mechanic' for 5th March, No. 1093, actually carried out by F. C. The planer as sketched by O. J. L. consists of an upright casting to be bolted down to the lathe bed, a tenon projecting between the shears keeping it from twisting. V strips on the front of this casting hold the planer bed in position, at the same time allowing it to partake of a vertical motion; a pin fastened in the centre of the planer bed projects through a slot in the upright casting, and engaging in a slot in a lever pivoted to an arm projecting to the rear of the upright casting, the handle of the said lever coming well in front gives a power of about three to one. The whole of this can be bodily shipped or unshipped from the lathe without disturbing anything, the slide-rest in its normal position being already conveniently placed to cut parallel or vertical, or, with a rest that swivels, at any angle to the planer-bed, the only alteration being that the Willis or other tool-holder has to be removed and another one of simple form, which will allow the tool to slightly lift on the back stroke. This is the simplest form of lathe planer I know of, and castings of it in the rough cost 10s., or with the necessary parts planed, 22s.; or finished complete, for, I presume, a five-inch lathe, 50s., of Patrick, Engineer, *Chelmsford*; particulars, stamp. E. B. F. suggested a pin in driver chuck or face-plate to engage in a horizontal slot in back of planer-bed, thus leaving both hands at liberty, the said pin or stud to be adjustable to or from the axis of lathe according to the length of stroke required. T. C. went further than this, and retained the lever which, however, was modified as follows: the pivot on which it turned was fixed in its centre, and its rear extremity carried an adjustable weight to balance weight of planer-table or bed, and work combined. Its front extremity was joined by a connecting rod to an extension of the top (not

face) of planer-bed, between front extremity and centre was a slot in which geared a stud or pin, adjustable, from face-plate, back gear was used, and as this design gave a slower motion, and, therefore, greater power during the cutting action, a bigger cut could be taken, whilst at the same time, it provided a quick return motion; see Shelley's 'Workshop Appliances,' page 249, Longmans, a book I can recommend, with 209 wood cuts, price 3s. 6d. In the 'Lathe and Its Uses,' is an illustration of a lathe planing machine, by Munro, but this is a large affair and costly, driven by an upright shaft connected to the crankshaft by bevelled gear, the upright shaft carrying a large face-plate with an adjustable pin, and connecting rod hinged to planer-table; and Northcote in his work on the lathe also, I believe, describes another modification of lathe planer, but not having the book by me at present, I am unable to give particulars; but speaking generally, I believe the work is fixed to a planer table, which has v's to fit lathe bed, and is made to travel to and fro on the bed, to the right hand extremity of which latter, an L casting is bolted, rising high enough to clear the work on the table, and then projecting to the left and *over* the bed to a distance equalling the greatest proposed stroke, to the left hand end of this projecting arm is fixed the cross-slide and tool-box, etc. The range of work in this latter is greater than that of O. J. L.'s, but at the same time there must be a very great deal more of rigging up and unrigging; the limit to the length of stroke in O. J. L. is governed by the height of centres; thus a five-inch centre lathe might be able to plane 5 inches, or by cranking up the tool, a practice not to be recommended, even 5¼ inches to 6 inches in a vertical direction, whilst the length horizontally would depend on the size of the slide-rest, and I think that within these limits O. J. L.'s design has much to recommend it. Another design called the 'Girder' lathe planer, by its inventor, is illustrated and described in Vol. XLIII, No. 1102, page 215, by Mr. Balck, its patentee. I see that Lee's shaper for the Lathe, to shape 5½ inches by 5¼ inches, and take 5¼ inches high, costs £9, a sum which would nearly buy four of O. J. L.'s; and this presumes that the purchaser finds his own slide-rest, and the Shaper, which is not complete without a slide-rest, if sold complete costs £13 15s."

Castings of Model Engine.

VISHNU.—Your letter with reference to Castings of Model Engine has been sent on to the firm named therein. There is some mistake which, doubtless, will be set right. To such a letter as you have written about this affair, you should have appended your name and full address, as a testimony to your own good faith in the matter. I do not think I am wrong in identifying you with SHRI KRISHNA, when I look at your *nom-de-plume* as given above. If so, you will remember that you wrote about Japanese Vases or Saucers for Mr. Gleeson-White's "Shaving Glass," and I referred you to Mr. Walter Craig, *Wick, N.B.*, who very kindly sent a pair to be forwarded to you. This I could not do, owing to want of name and address. So you see, even in small matters, as well as in the weightier one which forms the subject of your present letter, it is as well to drop the mask as far as *I* am concerned. You lose a pretty pair of saucers on the one hand by not giving it, and on the other, not finding your name and address appended to your letter, I am naturally compelled to regard it with some degree of suspicion. However, I have done my best for you in the matter.

Drill Chuck for Lathe.

S. M. L. (*Goderich, Canada*) writes:—"I have used for some time past a drill chuck (from a hand drill) mounted in lathe, in a manner somewhat similar to that given by Mr. G. T. Hardman in the October issue of AMATEUR WORK. Instead of mounting chuck and spindle in a larger chuck, I had a taper plug made to fit the hollow mandrel of lathe. It runs very true, and I value it much."

Working Model of Locomotive.

S. M. L. (*Goderich, Canada*) writes:—"For the benefit of model engineers who have any doubts as to whether models (made to scale) will not work, I would refer them to the issue of the 'Scientific American,' of October 23rd, where an account is given of a model locomotive, made by a gentleman during his leisure hours. It is a marvel of skill and patience."

INFORMATION SUPPLIED.

Silvering Clock Dials.

D. B. A. sends the following in reply to J. H. S. (*East Dulwich*). It is a recipe taken from an old work, but D. B. A. has not tried it, and therefore cannot vouch for its efficacy:—Dissolve ½ oz. silver in 1 oz. aqua fortis; add half a pint of water. Pour into another vessel, and clear from sediment. Add a spoonful of common salt which will precipitate silver in form of a white powder or curd. Pour off the acid and mix the precipitate with 2 oz. salt of tartar, ½ oz. whiting, and a large spoonful of salt. Mix well, and it is ready. To apply this: Clean brass with rottenstone, rub with salt and water, then rub a little of the composition on with the finger. Wash well with water. When dry, rub with rag and varnish. Repeat till covering of silver is thick enough.

Bagpipes.

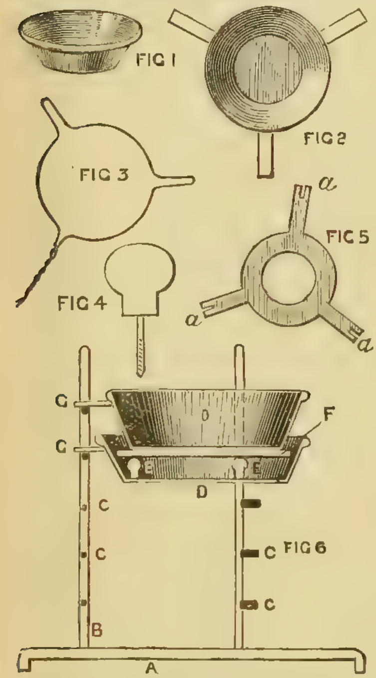
A. J. (*Rugby*) writes in reply to J. W. S. (*Orkney*):—"If you have a good lathe and are a good hand at turning, you may make a stand of pipes. The wood must be either ebony or cocoa wood, no other is any use. They are made in three sizes—military, reel or half size, and chamber. The reel would be the best for you to try upon. The drones are: 1st, large, about 3 feet long, in four sections, viz., socket fixed in bag; 2nd, tube 9 inches long, reed fixed in bottom and top; 3rd, tube 9 inches, fixed over reed at the top, the bottom reed goes in socket in bag; 4th, tube 9 inches, with ornamental head to crown. Two small drones about two feet long, without the fourth piece, and an ornamental top to third. I append a list of prices for chanter and reeds: Reeds, 9d. and 6d., Marr and Co., *Inverness*; also music, etc., can be had here. J. and R. Glen, 3, *North Bank Street, Edinburgh*. Reel bagpipes from £2 10s. to £5, according to mounting. Bagpipe chanters, ebony or cocoa, 10s. 6d. and 8s.; reeds, chanter, best, 9d. and 6d.; do., drone, do., 3d.; music, Glen's collection, Part 1, instructions, and fifty-two airs, 3s. You can get good stuff there, and I have no doubt any parts. If you want a second-hand pair, an advertisement in *Scottish Highlander, Inverness*, or *Glasgow Mail*, will soon bring you offers."

CO. CAVAN writes in answer to J. W. S. (*Orkney*):—"Length of long drone of Highland pipes is 2 feet 2 inches. There are two joints in this drone for tuning, which can be screwed out to make it 2 feet 8 inches. The size of the bore is ⅜ inch, tapering a very little towards the top. Length of the two short drones is 11 inches, with one joint to draw out to 15 inches, for tuning also. The bore of these are the same as the other, ⅜. You can get reeds for chanters and quills for drones from Butler, *Haymarket, London*. As to wood, whitehorn, apple-tree, cherry-tree, ebony, or, in fact, any close-grained timber will do. You can get the chanter from the above-named firm, but if you have a lathe and any sort of a hand at it, you can make as good a chanter as you can buy. If you try it I will give you length, size of bore at each end, position of holes, how to clean the bore, etc. I am only a poor hand at the lathe, and it is only a wooden construction; and I have made three sets of pipes as good for playing as you can buy for £5 5s., and did not cost me 15s. each. I will do anything I can for you." [CO. CAVAN does not append his name and address, so it is not possible for me to place J. W. S. (*Orkney*) in communication with him.—ED.]

Lallande-Spence Primary Battery.

RACAVAR writes in reply to EURIPIDES:—You ask (Vol. V., page 528) for an insulator capable of separating the zincs from the cells as well as the cells from each other. I will suppose that your trough-shaped cells or pans are of the shape shown in Fig. 1, more or less, of course: then to each pan or trough attach three arms, placed horizontally and equidistant, as shown in plan in Fig. 2; or, if unable to do this, then take a piece of stout iron wire and bend it as in Fig. 3. Having prepared either the one or the other system to each pan, then purchase at the nearest shop *three* insulators (porcelain) to each zinc, of the height required. If you are in a place where you cannot get the insulators, then buy three porcelain (white) knobs to each zinc (such as are used for small drawers) of the shape shown in Fig. 4. Remove the iron screw from each. Three of these insulators are to be put in the bottom of each pan or trough, on which the zincs are to rest, isolating them thus from the bottom of the pan. In order to avoid the inconvenience of the insulators falling down, you may attach them to a piece of wood of the form shown in Fig. 5, shown in plan. The hole in the centre is intended for lightness only. The insulators, or knobs, may be fixed in the places marked A, A, A. If you cannot apply the above arrangement,

then you may suspend the zincs by means of three silk cords from the horizontal arm of the trough or pan immediately over each zinc, renewing them of course as they wear out. The pans or troughs are then piled one above the other, between (note well) three wooden posts provided with arms at right angles to the posts, on which the pans or troughs rest by means of the three horizontal arms, as shown in Fig. 6. In this manner your battery will not present an unsightly appearance, and at the same time you will arrive at what you want. If, however, you think that the substances you require to work it with are expensive, why not adopt the following plan, which is certainly cheap, and which does not require a very particular attention :—



INSULATOR SEPARATING ZINC FROM CELLS.

Fig. 1.—Cell or Pan; Fig. 2.—Cell in Plan with Arms attached; Fig. 3.—Wire, bent to take Cell and form Substitute for Arms; Fig. 4.—Porcelain Knob; Fig. 5.—Wood to prevent Insulators from falling; Fig. 6.—Arrangement of Cells; A, Wooden Base; B, Wooden Posts; C, Arms at angles to support Pans; D, Cells or Pans; E, Insulators or Knobs; F, Zinc; G, Horizontal Arms.

(1) Tin your troughs or pans.

(2) Provide horizontal arms as above.

(3) The bottom of each pan to rest on zinc disc.

(4) Coat bottom of pan with pulverised sulphate of lead moistened with water.

(5) Pile up as above.

The battery is then charged by pouring water into the iron pans. If you want a stronger current, instead of water, put a concentrated solution of salt and water.

Book on Ornamental Glass-Blowing.

E. J. S. (*Westbury-on-Trym*) writes in reply to Godresjee (*Bombay*) :—"I recently saw in the 'English Mechanic' a very favourable review of 'The Methods of Glass Blowing for the Use of Physical and Chemical Students,' by W. A. Shenstone (Lecturer to the Clifton College), published by Messrs. Rivington and Co., *London*, which I gathered was by far the best book on the subject in the English language." [This is a recent publication, but as I have not seen it I am not in a position to express any opinion on it.—Ed.]

Casting of Woolwich Infant.

S. M. L. (*Goderich, Canada*) writes, in reply to A Reader from the First :—"If you will apply to Mr. R. A. Lee, of *High Holborn, London, W.C.*, I believe you can get from him a casting of the 'Woolwich Infant,' $8\frac{3}{4}$ inch. Scale $\frac{1}{2}$ inch to 1 foot."

Black Ink for Rubber Stamps.

C. A. P. writes in reply to Prof. L. Marissiaux (page 48 of this Vol.):—"The following is a good ink for rubber stamps: Aniline black, 90 grains; rain water, 1 oz.; then add a small quantity of glycerine and treacle. The quantity of glycerine and treacle to be added will vary with the season, but about half a teaspoonful will be found sufficient for the above quantity of aniline and water. A brighter impression and greater durability of the ink is secured by the addition of the treacle. Here is another good formula: aniline dye, 1 oz.; hot water, 5 ozs.; glycerine, 1 oz.; treacle, $\frac{1}{2}$ oz."

INFORMATION SOUGHT.

Works on Model Engine Making.

S. M. L. (*Goderich, Canada*) asks: —"Will some brother amateur kindly give me the names of any treatises or works on 'Model Engine Making?' I may say I have 'The Young Mechanic' (Lukin), and 'How to Make a Steam Engine' (Dickson), but these treat only on simple forms of engines. Sergeant A. Sharpe, I believe, commenced a series of articles on above in 'Amateur Mechanics,' but I believe only one chapter appeared."

Picture Frame Making.

Only an Amateur wishes for a few hints on making and putting on composition mitre pieces on the corners of picture frames.

Mica : Where to Buy.

R. K. (*Chelsea*) writes :—"Will you kindly inform me in 'Amateurs in Council,' where I can purchase mica in the sheet, as I want to make a lantern-shaped globe for kitchen gas, as the ordinary ones are always breaking with heat, when I have a mica smoke consumer above them.

Improvement in Davy Lamp.

R. K. (*Chelsea*) writes :—"Can you also inform me where I can obtain any information about the latest improvements in safety lamps for mining. I have never seen one, but have a woodcut of the Davy Lamp in a Cyclopædia. After several experiments I have effected an improvement on the 'Davy,' but for all I know, it, or a similar contrivance may be in use at the present time. I went to the Patent Museum at South Kensington, but the things are all removed." [I can only recommend you to go to the Patent Office, *Cursitor Street. Chancery Lane, E.C.*, for information about the latest improvements in safety lamps; but how can you claim to have effected an improvement in a lamp, which, if I read your communication aright, you have never seen, and know only by woodcut in a Cyclopædia. Inventors, who seek to improve on an existing article, must make experiments on and with the actual thing, if they hope to do anything really useful.—Ed.]

Stake for Seaming Sheet Metal.

Tinman writes :—"I shall feel much obliged if any of the readers of Amateur Work would furnish me with the address of a firm where I could buy a cheap stake for seaming the bottoms of sheet metal articles on, with price of same, or any suggestion how to make a substitute will be gratefully received. I've written to a maker of such tools, but the price asked is beyond my means."

Billiard Table.

H. B. J. (*Worcester*) writes :—"Will any reader kindly inform me how to make a small billiard table, giving plans, etc.; one about 8 feet by 4 feet, or 7 feet by 3 feet 6 inches; also stating where I can get the slates (if any required) and the India-rubber, and giving somewhere about what the prices of each article would be. I should like it, if possible, to be made with a frame without legs, so that it might be lifted on or off the dining table, as there is no room for a real table. Please give dimensions of pockets, etc.

Octave Coupler to American Organ.

Semper Paratus writes :—"Will any of 'ours' kindly give instructions as to adding an octave coupler to American organ, or harmonium. On looking through back vols. I find in Vol. III., page 494, a subscriber was willing to give instruction, and the Editor asked for the information with suitable diagrams, but I do not see them, although I have carefully searched for it." [No! the "Subscriber" after professing his readiness to do what was requisite took no further steps in the matter. Another gentleman wanted to be paid for his contributions before they were written, and although I am always anxious to oblige every one as far as I can, yet being unwilling at any time to make one in the little game popularly known as the "Confidence Trick," I was unable to bring myself to go quite so far as this. A third gentleman who has actually been successful in making an Americal Organ, also offered and agreed to write a series of papers on the subject for the benefit of readers of Amateur Work, but he, too, is either too busy to proceed or mistrusts his own powers as an instructor of others. I heartily wish persons would never make offers unless they really mean business, and are *semper parati*, it would save them a little trouble, expectant readers much disappointment, and me considerable annoyance.]

LETTERS RECEIVED UP TO NOV. 17.

[*Replies to these in Next Part.*]

Tasmanian; J. J. F.; Organist; Jack Leigh; H. A. S; J. T. (*Plaistow*); W. L. (*Golborne*); C. A. P.; C. W. N. (*Southgate*); L. W.; S. M. L. (*Goderich, Canada*); J. H. R. (*Anglesey*); Greenhorn; J. H. (*Canonbury*).

THE VANISHING LADY:

THE LATEST MYSTERY OF MODERN CONJURING.

By D. B. ADAMSON.

PROBABLY no trick or illusion, call it which you will, has so suddenly and generally become popular as the one known as the Vanishing Lady. Only a few months ago it had not been heard of, now it is being shown by dozens of conjurors, who have performed it in hundreds of halls and places of amusement, to the bewilderment of the uninitiated. Like most others interested in such matters, I was completely mystified when I read the account of this wonderful new trick in the daily press, from which it seemed incomprehensible, and to baffle any attempt at elucidation. It was, in truth, sufficiently marvellous. Briefly stated, the description was, that a lady, having taken her seat in an ordinary chair, was covered with a large cloth or shawl, under which her form was distinctly visible, but on the cloth being removed, she had utterly vanished. This, with other details, apparently proving that there could be no deception, was the story which was told. Naturally enough, Messrs. Maskelyne and Cooke were not long in adding such a wonderful item to their always attractive entertainment, and so lately as, I think, last July, they announced its first performance in this country. They were, I believe, the first to introduce it to the British public; but I may be mistaken, for almost simultaneously hosts of other performers were about with it, both in London and the provinces.

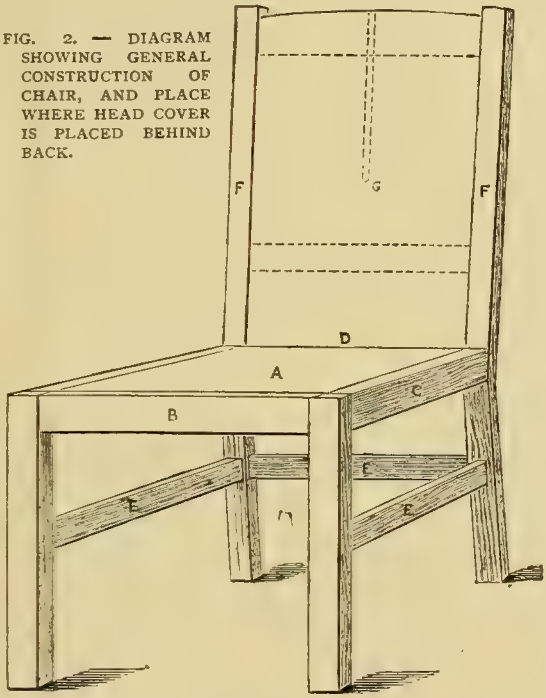


FIG. 2. — DIAGRAM SHOWING GENERAL CONSTRUCTION OF CHAIR, AND PLACE WHERE HEAD COVER IS PLACED BEHIND BACK.

When well presented, it is a very taking trick, but unfortunately, owing to clumsy manipulation, it is not always seen to advantage, more than one performer having unintentionally shown how the disappearance is effected. But for these mishaps, the trick might have remained as close a secret as it was when brought to London. So valuable was it then considered, that just a short time before it had been shown, £120 was named to me as the figure at which I could buy it. I did not avail myself of the offer. A few weeks after, it was reduced to less than as many shillings, and I understand, at the present time, the trick, or rather, the trick chair, can be had for 30s. or 40s., if one goes to the right market. I fear I shall always regret not having "beared" Vanishing Lady. Of course, my, and your, friend, the Professor, whose existence has been referred to in these papers, and I, had several talks concerning the new trick. He professed to know all about how it was done, but the only explanation he ever gave me was vague and unsatisfactory, so much so, that I could not understand it, that is to say, not completely. He said it was quite clear; and as it might be to brighter intellects than mine, I am very pleased to give his description for those who are good at conundrums. A singular fact is, that verbal explanation was withheld, all being done by signs, which to me were as mysterious as those of freemasonry. All he did was to close his right eye, stare at me with his left, and place the forefinger of his right hand perpendicularly against the side of his nose. He said he could not explain it more fully if he talked all night; very likely he was correct. By the way, I don't think I have ever mentioned the Professor's name: it is Ananias, but he is generally known under an alias. He comes of a very old family, he says a female ancestor was named Sapphira, and that both she and the first of his name are well-known historical personages. He is believed by his acquaintances to inherit, in a marked degree, the chief characteristic quality of his ancestors; indeed, to those who know him well, he has, although a bashful man and not given to overweening pride in his lineage, been heard to admit as much when pressed. In this he tells the truth, which is a proof that the family is, to a certain extent, degenerating. There are a good many members of it about—most of us know a few. After this slight biographical digression it may not be amiss for me to explain how I got to know the Vanishing Lady trick.

I was sitting one evening "turning over a few thoughts in my mind," which my youngsters say is the same thing as going to sleep, only without going to bed, when I was roused by the announcement of a visitor, on whose card I read, "Mr. ——, Illusionist, etc." I did not recognize the name, nor when Mr. —— came in could I remember having seen him before. He explained his visit by saying he had read some articles on Conjuring in AMATEUR WORK, and that he had taken the liberty of calling on me to enquire if I was the writer. Now, there are a few conjurors who object to any of the secrets of the craft being published, and I presumed my visitor might be one of these. However, as it turned out, he had simply called to congratulate me on—but, no, modesty forbids me to repeat the very flattering remarks he made.

During the evening we talked a good deal of conjuring "shop," very little of which would interest readers, so I do not reproduce our conversation. The gist of it was that Mr. —— had been a professional medium, and as he said—"Of course, I had to know something about conjuring, that I might not disappoint visitors in case the spirits would not help me during a seance: as a matter of fact the spirits always did fail to assist, and I relied entirely on conjuring and the ordinary arrangements which you are no doubt well acquainted with. My 'business' was principally 'materialized spirits.'" Qualms of conscience induced him to think about abandoning this, and his decision was hastened by one or two exposures brought about by some unbelievers in spiritualism having surreptitiously strewn the floor in front of the medium with a quantity of sharp tacks. "Of course," he continued, "when I had disposed of the tests, and was walking as the materialized spirit, without my boots, I trod on the tacks, and though I did my best to convince those present that my control was a mischievous spirit, I met with so little sympathy that I gave up spiritualism and have now taken to the legitimate branch of conjuring."

He informed me that he was about to show the Vanishing Lady, and he good-naturedly explained to me the way he did it, on my remarking that I should like to write an article about the trick for AMATEUR WORK. He also invited me to examine and make any sketches of his chair that I might require. Unfortunately, circumstances prevented me availing myself of this offer, and it is therefore just possible I may have erred in some trivial detail, but I think not. I regret I am not able to give exact measurements, consequently the illustrations are not drawn to scale; but I do not apprehend any serious difficulty will arise from this omission. Those who wish to make the chair and perform the trick will be able to do so easily by a very slight attention to the following instructions:—

To begin with, this is essentially a stage trick, as a trap in the flooring is required, but for private performances, a small stage or platform can readily be made. For those who want a suggestion, I give an idea of how this might be managed, Fig. 1. It is, in fact, merely a table sufficiently strong to bear the weight of two people on it, and large enough for the performer to move about without his movements being hampered. The top must have a trap, and that the outline of this may not be visible to spectators, the height of the stand should be at least as high as their heads. The stand must be boarded or curtained all round, so that no one can see underneath. If it can be placed with its back to a doorway covered with a portière, or in such a position that the lady, after disappearing through the trap, can leave the room without being seen, the front at least ought to be draped, so that the curtain might be drawn aside to prove it empty. I merely throw out these hints for beginners, as those who are well up in conjuring will be able to devise their own arrangements.

The object is to bewilder spectators, and the extent to which this is done will depend on the skill of the performer. His aim must be to cause the lady to vanish without giving any clue to the mode of disappearance. As shown on the stage, the chair is the principal piece of apparatus required. Several modifications or patterns are used, according to the fancy of performers, but the principle is the same, viz., the seat is hinged, the back is not open, *i.e.*, the whole, or the greater part of the space between the uprights must be covered, and behind the back, a contrivance is fixed to support the shawl in place of the head of the vanishing, or rather, the vanished lady. As told to me, the arrangement of the chair is as follows:—

See Fig. 2, which is purposely drawn plainly, in order to indicate only the points necessary to be observed, and not to imply that it need be devoid of ornamentation. Indeed, in appearance, it should be as much like an ordinary chair as possible. The seat, A, including the front rail, B, must fit in and be independent of the side rails, C, and must be hinged to the back rail, D. The hinges being fixed so that the seat may fall, as shown in Fig. 3 by the dotted lines. The seat, in fact, must have its own frame, of which the front rail must look like part of the ordinary chair frame, while the sides and back (of the loose frame) are hidden by the side and back rails, C and D. In appearance, accordingly, the seat, apart from upholstery, very much resembles the now old-fashioned pattern, known as the "Trafalgar." The rails, E, E, E, are introduced solely as strengthening stays, and may be at any part of the leg, but there must be none

in front, or in any position where they would affect the dropping of the seat. The back of the chair should be rather higher than usual in ordinary dining-room chairs, up to, or even a little above the shoulders of the lady when seated. The back should also be a good width, so that the uprights, F, F, may be seen on each side of the lady's arms when she is seated. The dotted lines indicate the cross rails, of which there may be several, to afford strength, or only a couple to fasten the upholstery or lining to. The top rail also is the part to which the contrivance, already mentioned, is fixed. This consists of a piece of iron, or metal, to one end of which are attached two or three other pieces of metal bent in such a way as to form a sort of skeleton cap when brought over on to the head of the lady. Three or four pieces of strong wire about one-eighth inch thick, bound together, spread and bent at one end (as Fig. 4) do as well as anything—at the lower end they must be hinged to the back of the chair—behind it, as indicated by the dotted lines, G, Fig. 2. It is immaterial where the hinge is placed, provided it is so that no part of this contrivance, when down (Fig. 5), is visible from the front.

It will be remembered that, so far, only *framing* has been mentioned. The covering or stuffing of the back is necessary to prevent this arrangement being visible. I have seen some Japanese masks covering the top of the head as well as the face, and it occurs to me that, if strong enough, the piece going over the head would be just the thing for the vanishing lady trick, instead of the bent fork arrangement generally adopted. I think it will be gathered from what I have written that the height of this cap must be made so that it just comes over the lady's head.

Nothing has been said yet about the seat being kept up so that it may be sat upon. Near the front, H, Fig. 3, at each side must be a bolt, or spring catch, preferably the latter, fixed to the rails C, and supporting the seat. The bolt, or whatever is used, must be underneath, and sunk so as to be out of sight to the audience. The seat and back may be stuffed or covered, say with the "perforated wood," now so largely used. So long as the back is covered, it does not matter what material is used. A piece of plain linoleum neatly fixed would serve as well as anything. The only point to be attended to in the seat is that it should be strong enough to bear sitting on.

The apparatus being ready, the mode of working the trick is as follows:—The lady (without an "improver," or crinolette, please) takes her seat, placing her hands against the side rails by the bolts, H, in such a way that she can, without much movement, draw them. The performer places over her a large shawl, completely covering her, while doing this he brings up the hinged iron so that the bent pieces are over the lady's head. The shawl should be well spread out, especially towards the front, and while it is being arranged the lady withdraws the bolt, descends through the trap, fastens the chair seat up again, and finally closes the trap, or this may be done by the assistant who will probably be below to open the trap, assist the descent, etc. It will be seen that the wire head-piece supports the shawl after the lady has vanished, and if she goes while the performer is arranging the shawl, when he has finished it will not be noticed that no one is under it. Sometimes to complete the illusion, the lady (or the assistant) from below moves the shawl by placing her arms up, thus apparently proving she has not left the chair. The performer next removes the shawl, beginning by raising the front and gradually drawing it to the back, which movement causes the iron arrangement to again drop behind.

This part requires some care to do it well, but as in many other moves in conjuring, it is not easy to convey instruction without ocular demonstration. Any stiff material will do for the shawl. I believe silk of good substance is considered the best, as it readily lends itself to the folds of the performer when spreading it out—velvet and such-like soft and clinging materials would not do so well. I think I remember there used to be a material used for ladies' dresses called bombazine; I may be mistaken, but I do not venture to ask any lady whether I am correct, it was so long ago, and ladies never grow old. No; it would never do to ask one of them if she remembers it. Perhaps some reader may be more venturesome.

Sometimes performers, to show that there is no trap in the stage, lay a newspaper under the chair. This paper, like most other things used in conjuring, is prepared. It is brought forward by the performer folded in two, or in any way to conceal the prepared part. The side or fold next the audience is not arranged but the other is cut. Fig. 6 shows how: B is the fold, A the half shown, concealing the other half, which is cut through at the dotted lines C C. This second half is laid down so that the cuts are just over the sides of the trap, which is covered by the piece included, by C C, and part of the fold B. The front part of the paper is next laid down, having so far merely served as a screen for the prepared half or part. It now only remains for me to help the amateur showman with his patter.

Ladies and Gentlemen,—I have now the pleasure of showing you one of the newest, if not the newest, scientific illusion of the age. The times in which we live are times of rapid progress and advancement, one discovery succeeding another with marvellous rapidity. The spread of education has rendered it necessary for even our amusements to partake of a

philosophic character, and though some may be inclined to think that a conjuring trick is a poor result to be striven for, I am sure you will not say so when you know the capabilities of, and the useful purposes to which the discovery I am about to show you may be applied. Let me give an instance:

Yesterday, after my performance, a gentleman came to me and implored my assistance. Oh, dear! he looked miserable, so miserable and careworn that I pitied him from the bottom of my heart. I asked made my new acquaintance. His smile, I assure you, was perfectly angelic, and my own bosom was swelling with great and good thoughts, when he leaned towards me, and breathed rather than spoke: "Would you, oh! would you come to my house and vanish my mother-in-law?"

Oh, you may laugh, young man. Are you married? No; I thought not, or you would not laugh so at mothers-in-law. I have had two of them, but no more—no more. I vanished them; ha, ha! Mothers-

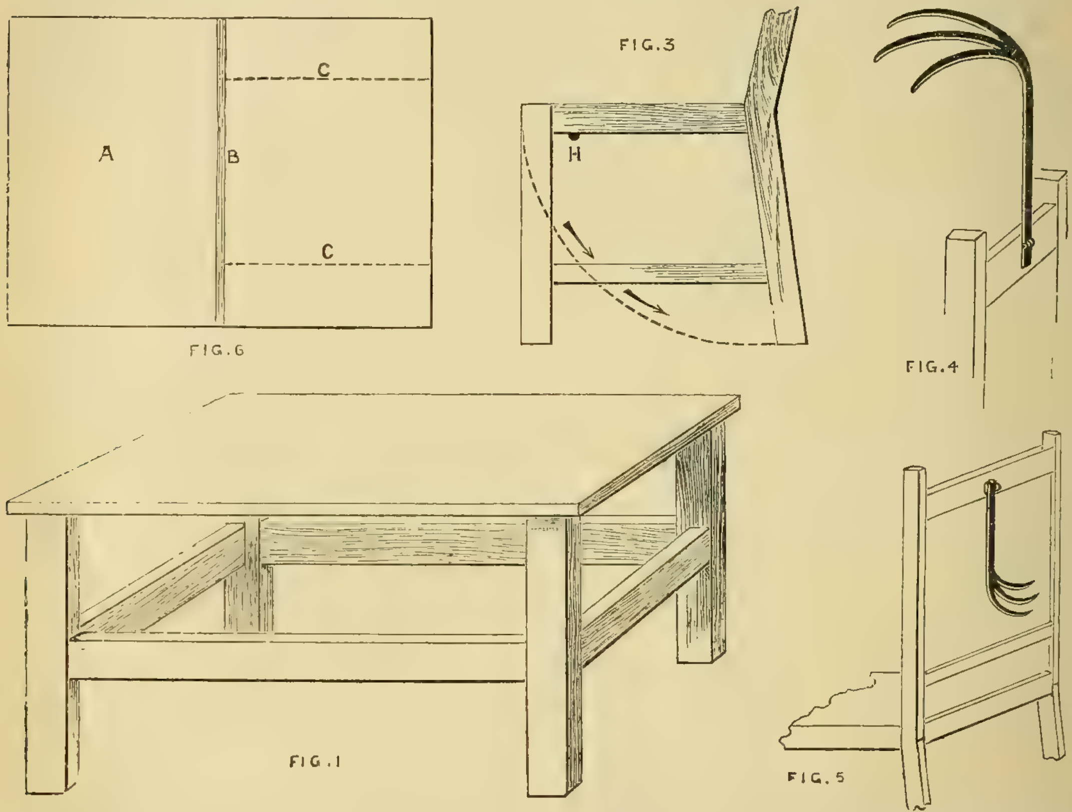


FIG. 1.—TEMPORARY STAGE. FIG. 3.—SIDE VIEW OF CHAIR, SHOWING HOW SEAT FALLS. FIG. 4.—IRON CLAW SUPPORTING SHAWL AFTER LADY HAS VANISHED. FIG. 5.—BACK OF CHAIR, SHOWING POSITION OF CLAW WHEN NOT IN USE. FIG. 6.—PREPARED NEWSPAPER TO BE PLACED UNDER CHAIR BEFORE THE LADY IS SEATED.

him what he wanted me to do, but instead of giving me a direct answer, he wished to know if I could vanish anybody. Of course, I assured him I could, nothing easier. At last he seemed convinced, and with wonder I saw his countenance assume an aspect of calm repose—remarkable as a contrast to his haggard appearance when he came to me. Ah! ladies, and especially gentlemen, I had given a fellow-creature back again the joy and happiness of childhood, all in a few minutes. Was not that worth doing? I myself beamed with pleasure in sympathy, and I wished I could make all mankind as happy as I had

in-law, however, are very useful members of society—nay, more, don't they love our better halves as we ourselves. Besides, would anyone wish our little darlings—who almost as soon as they can with mighty effort, doubtless with inward pride (not to the parents, on, no! not at all, but to themselves) enunciate "dada," try to say "grandmamma"—to be deprived of the dear, good old soul, who does her best to ruin their young digestion with sweeties. For these reasons I was compelled to decline that sorrowful man's invitation.

Almost every day I have requests that I will

vanish some one. Men ask me to vanish, for instance, tax-collectors, people to whom they have given bills, people they are owing money to—all sorts of disagreeable people to them, but, of course, I never do. Gold untold, with all the diamonds of the universe added, would not make me. Sometimes I am inclined though to ask some people—that is to say, disagreeable people to me—to sit on my chair and allow themselves to be vanished.

For example, the man who, though very much painted and got up coarse clay, tries to impress strangers with the idea that he is the superfine porcelain of human nature ; also the kind of individual who drives up in a conveyance that is an evident "growler," with an unmistakable "cabbie" on the box, and says, "John, haw—d(r)ive the ca(rr)iage to the—a—fellow who's a," etc.; likewise snobs and the people with much side but no heart ; the reverend gentlemen of the great unpaid, who preach beautiful, oh such beautiful sermons founded on an injunction bearing on little children, and then go straight off to punish harshly the poor little waifs and strays, who, through no fault of their own, are not as other children—that is to say, their own and respectable people's children. These and all other shams I would willingly vanish all day long, and bequeath the secret of my chair for the good of posterity.

Well, as I was saying, to convince you that this is no illusion, and that there is no such thing as a trap-door, I place this newspaper on the floor. I use the *Telegraph*, which is much more expeditious than the *Post*, I find. I cover the lady with this shawl, etc.

In addition to the Vanishing Lady trick now described, there is at least one other variety. I allude to it, as although it is known by the same name, the only point of resemblance between them is that the lady vanishes, and I should be sorry for anyone to confuse the two.

I describe the ordinary form of the trick as it can hardly be called a secret now, but it would be an injustice to the talented inventor of the other, Professor Winstone, to publish his method, especially as he has been kind enough to communicate to me without reserve. It may not be out of place to mention that this gentleman is the inventor of Thauma, a well-known illusion, which he has given me permission to fully describe. Though explanations of it have been published, all that I have seen are more or less inaccurate, and differ from his arrangement, which I recently had ample opportunity of learning, having, with his assistance, arranged a Thauma show in connection with a bazaar in which I took an interest. Therefore, I hope that readers of AMATEUR WORK may soon be as well up in it as I am. For the present, good friends, adieu !

DRY-PLATE PHOTOGRAPHY :

THE GELATINO-BROMIDE PROCESS.

By C. C. VEVERS.

IX.—CHILDREN—GHOST PICTURES—DOUBLE PORTRAITS—PHOTOGRAPHY BY ARTIFICIAL LIGHT—COPYING.

CHILDREN are very difficult subjects to photograph, and should never be attempted indoors ; a rapid exposure is the first point to consider. Babies and very young children may be taken well in a chair over which a hair rug has been thrown. Many pretty positions for older children will occur to the artistic mind, and lovely *genre* pictures can sometimes be obtained under favourable circumstances. Plenty of toys are essential to a successful picture, and the popular bird charmer or squeaker has been known to do good service in its time. Do not be in a hurry to get finished with them, and a pleased and interested expression may often be got if the child is old enough to understand, by relating some pretty story about "a little bird that lived in a cage and one day got lost," etc., etc. Perfect quiet will be obtained during the search for the bird (and exposure), and its discovery behind the camera (after exposure) will be hailed with great glee, to the infinite satisfaction of all concerned.

Many ways of deriving winter amusement with the camera will suggest themselves to the amateur. Among these I may mention portraiture by artificial light, "ghost" pictures, and double pictures ; and upon these a few words may be of some help to my readers.

It must not be expected to produce photographs by artificial light equal to those taken by daylight, but very fair results are sometimes obtained, and much pleasure derived from the experiment. Electric light often forms the source of illumination. Many hints on its use may be found in the back numbers of the *Photographic News* and *British Journal Almanacs ;* but, perhaps, Mr. Edwinson may be prevailed upon to describe in "ours" the construction of a lamp suitable for an amateur photographer's work. Magnesium powder and ribbon both produce a brilliant and actinic light, and now the price has so suddenly fallen from 12s. 6d. to about 2s. 6d. per ounce, its use does not drag so heavily upon the pocket of the experimentalist. A very cheap illuminating compound may be made up as follows :—

Nitrate of Potash (saltpetre) ..	14 ounces
Sulphur	2 „
Antimony	1 „

This compound may be made more actinic by the addition of about ½ ounce of magnesium powder; as it gives off choking and sulphurous fumes it should only

be ignited in a place where they can be carried away as soon as possible. An exceedingly brilliant light, much more actinic than that produced by an electric arc lamp, can be obtained by burning magnesium in oxygen gas. Mr. Beach, a clever American amateur, and President of the Society of Amateur Photographers of New York, has perfected an apparatus for burning magnesium ribbon in oxygen gas and igniting it simultaneously in two or more lamps by means of electricity, and has worked it with complete success in the Society's Lecture Hall. A report of his description of the machine appeared in the *Amateur Photographer*, March 12th, 1886. Another method of burning magnesium powder was given in the *Photographic News*, December 16th, 1885, and is less expensive than Mr. Beach's apparatus.

For a first experiment a tin box should be made, having an opening in the top for the escape of the smoke produced, and the front covered with a sheet of tracing or tissue paper to diffuse the light; either magnesium ribbon, powder, or the pyrotechnic mixture just mentioned may be burnt. The box should be placed a little to one side of the camera, and about 5 feet from the ground for a portrait; with a doublet lens, open aperture, quick plates, from 12 inches to 24 inches of ribbon or an ounce to two ounces of the Bengal light powder should be used, the stuff being ignited by passing a red-hot wire through a hole in the side of the box, and the exposure made simultaneously. A still softer light may be secured by moving the lamp from side to side during exposure, care being taken that it is not brought into the angle of view and included in the picture.

The two bits of mystery—ghost and double portraits—are very simply managed "when you only know how." The "ghost" is made as follows:—The picture should contain at least one figure of substance in addition to the ghost, and it may be made more interesting if it be illustrative of some well-known or historical ghost story, say, for instance, the one from Shakspeare's immortal plays, where Hamlet, the Queen and the Ghost are discovered, the *tableau* representing the former exclaiming—

"Look you, how pale he glares!
His form and cause conjoin'd, preaching to stones,
Would make them capable. Do not look upon me,
Lest, with this piteous action, you convert
My stern effects: then what I have to do
Will want true colour; tears, perchance, for blood,
* * * * * * *
My father in his habit as he lived!"

A long exposure is required, which, of course, may be got by stopping down the lens. The ghost effect is obtained by its representative quickly stepping out of the picture after two-thirds of the exposure has elapsed. Say fifteen seconds is the time necessary, the operator at the tenth second gives the signal and the ghost disappears, while the other actors remain in position till the lens is capped five seconds later. On development, the negative will be found to show the ghostly image *through* which every object in the background can be plainly seen.

A double portrait is, as its name implies, a picture in which the portrait of *one* person occurs in *two* different places; thus, we can make a photograph of a man drinking and playing cards *with himself!* There are two ways of getting a double portrait: the easiest, although not the best, is to take the subject against a very dark background; after the proper exposure has been given, he moves to the other side, and the same plate is again exposed. The next and better way is managed thus: after focussing with, say, the subject on the left side of the ground glass, a thin piece of black cardboard, tin or zinc *exactly* half the size of the opening is placed just before the dark slide—in the grooves of the reversing back, if the camera be fitted with this appliance, so as to cover the right half of the plate which is then exposed the required time. On the lens being recapped, the sitter moves to the other side of the picture, so that his image may appear on the right side of the screen, without displacing either camera or accessories in the slightest degree. The division or mask is now moved to the left side of the camera, and the plate re-exposed exactly the same length of time as before. When the plate has been developed, if the division has been made exactly the proper size, it will be found that the edges of the two exposures have vignetted so evenly one into the other, that no trace of the joining line down the middle of the plate can be discovered.

The photographer often wishes to make a copy of a photograph, engraving or painting, and sometimes an enlarged or reduced copy is required; this may be done in the camera in the following way, but the reproduction rarely, if ever, equals the original in point of clearness; and a photograph should never be enlarged beyond twice its size, as the grain of the paper, however smooth its surface may be, unless the exposure be exactly timed, and the light falls upon it equally from all sides, will be photographically reproduced and exaggerated in the copy which will have a coarse sandy appearance.

The photograph to be copied should be fastened to a flat board by means of drawing-pins; pictures should be removed from their frames as they cannot be taken with glass before them. The board supporting the photograph or picture is then placed in a good light—side light being avoided, the camera (the body of which should be made to extend to at least twice the length of focus of the lens employed) with

a rectilinear lens, if possible, so that there may be no distortion of straight lines in the picture, is placed opposite, the lens being level with the centre of the picture. To copy the same size as the original, the distance of the ground glass to the centre of the lens will be the same as from the picture to the lens, and will be double the equivalent focus of the lens used. To enlarge to twice the original size, with, as an example, a lens of 8 inch focus, the distance of the ground glass from the lens should be 24 inches, and from the picture to the lens 12 inches. A useful table for enlarging and reducing is published in the *British Journal Almanac*, a copy of which Mr. Parkinson gave in his papers on enlarging in Part 59. Focus for the centre of the picture, use a small stop, slow plates, expose as near correct time as possible, and develope slowly. If the subject be an engraving, *slightly* under-expose, under-develope, and afterwards intensify with mercury.

(*To be continued.*)

MY MARIONNETTE THEATRE:

HOW I MADE IT AND WORKED IT.

By EDWARD A. LEONARD.

I.—THE STAGE—ITS ARRANGEMENTS FOR LIGHTING—THE CURTAINS, SCENERY, AND FURNITURE.

EVERYONE has heard of the proud parent, who, indicating some piece of mechanism constructed by her son, remarked that "he made it all out of his own head, and had wood enough left to make another!"

My Marionnette Show was made in a similarly original manner, the wood, however, being supplied, not by my own head, but by a carpenter, who also did a good deal of the work from my designs, and, in the absence of a trumpeter, I must blow my own instrument, and proclaim that I am really a little proud of the result!

Perhaps this unseemly satisfaction may be due to my never having seen any other, or rather, to be strictly accurate, the method of construction of any other, not having penetrated "behind the scenes," or been initiated into the mysteries of the internal economy of those wondrous exhibitions, of which I have occasionally been an admiring and mystified spectator.

And here let me disclaim, at the outset, any pretension of aspiring to reproduce on my humble stage the highly elaborate mechanical effects of the professionals, with their acrobats, skeletons, and what not. Nevertheless, I still maintain that I have some reason to be pleased with my show. If it has not enjoyed the patronage of all the crowned heads of Europe, it has at any rate succeeded in holding quite spell-bound with delight a great many juvenile audiences, nor am I by any means certain that children of a larger growth who have come to take care of the youngsters, have not enjoyed the thing as much as any of them. And, after all, what *would* you have? If you can get a witch who sits down and works a spinning-wheel, a "Sleeping Beauty" who falls with closing eyes upon a couch; a distracted mother who throws herself in an agony of grief on the apparently lifeless form of her daughter; a lover who kneels down—and gets up again! what more in reason can you desire? And then the Dragon! "but we must not anticipate"; the Dragon deserves a chapter to himself.

To come, however, to business. My object was to construct a miniature theatre, for the performance of fairy plays such as children love, of such proportions as to be suitable for an audience of from one hundred to one hundred and fifty children, the characters being sustained by movable figures about 16 inches in height; the whole affair to be capable of being easily taken to pieces and packed into a tolerably small compass. These objects have all been successfully achieved in a manner which shall now be described as clearly as possible, it being merely premised that, of course, my plan may be carried out either on a larger or a smaller scale, as may be desired. For exhibition in a private drawing-room, smaller figures would certainly do, though I should not recommend much reduction in the size of the stage. A little more "sea-room" than is enjoyed by my figures when many are on together would be an advantage; and if I were beginning again, I should be disposed to make the stage a foot longer. Indeed, for an audience of one hundred and fifty, it would be better if everything were on a slightly larger scale than that given below. If the stage were enlarged, however, it would be necessary to have the legs of the table hinged for folding, otherwise it would be found impossible sometimes to get it through a doorway, and it would resemble the famous picture in the "Vicar of Wakefield," concerning which "some wondered how it could be got out, but still more were amazed how it ever got in."

It will be convenient to treat (1) of the Stage itself; (2) of the arrangements for Lighting; (3) of the Curtains, Scenery and Furniture; (4) of the Figures.

1. THE STAGE.—(See Fig. 1.) The first requisite is a deal table, the top of which, A B C D, measures 46 inches by 26 inches, and is $\frac{5}{8}$ inch in thickness. The ends A D, B C, each project 4 inches beyond the table bed, the depth of which is $5\frac{1}{2}$ in., the back D C projects $1\frac{1}{4}$ inch, the front A B is flush with the bed

The table legs are 30 in. long, 2 inches wide, and $1\frac{3}{4}$ inches deep.

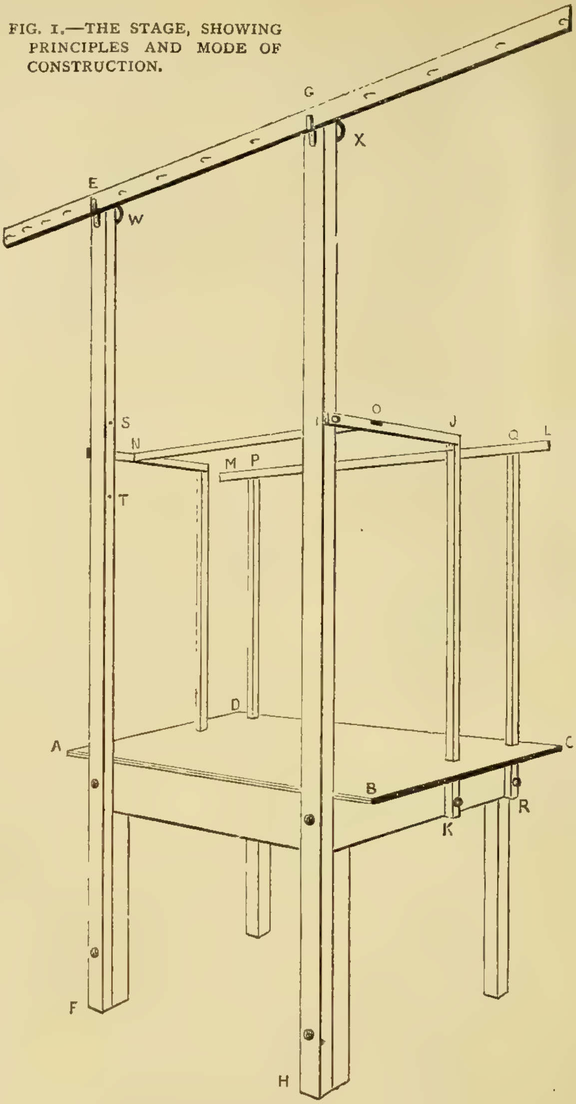
Next, two uprights, E F, G H, each 8 feet by 2 inches by $1\frac{1}{4}$ inch, capable of being fastened to the front legs of the table by four 3-inch thumb-screws (the 2-inch wide sides of the uprights joining to the 2-inch wide sides of the table legs).

The uprights are furnished at the top with small brass supports for the reception of a cross-bar 9 or 10 feet by 2 in. by $\frac{1}{2}$ inch. Immediately behind these supports, at the back of the uprights, are fixed the supports of an ordinary blind-roller, as will be seen in the diagram.

The width between these two main uprights is 42 inches. This will be the width of the opening of the stage.

The lighter portions of the framework are all 1 inch in width and thickness, and should be made of well-seasoned red deal. The height from the top of the table to the top of the frame, all round, is 36 inches. The side horizontal, I J, is $17\frac{1}{2}$ in.; it is hinged to J K at the angle. The small side uprights, J K, Q R, are 42 inches. The back horizontal, M L, is 56 inches. It projects at each end 4 inches beyond the uprights on which it rests. These two uprights terminate at the top in square pegs, which fit into holes in the horizontal at P and Q.

FIG. 1.—THE STAGE, SHOWING PRINCIPLES AND MODE OF CONSTRUCTION.



To prevent the horizontals being knocked off by an accidental upward blow, small brass pins may be pushed in from behind, running through the pegs, but not coming out in front.

Another horizontal, which may conveniently be distinguished by being called the rest-bar, 48 in. in length, rests in notches at N and O, so that its upper side is flush with the rest of the top of the frame-work. The space between the rest-bar, N O, and back horizontal, M L, is $17\frac{1}{2}$ inches. That between the side uprights, J K and Q R, is $7\frac{1}{2}$ inches.

These uprights, it will be seen, are secured in their places by passing through holes 1 inch square in the table, and being screwed to the flange, each by a 3-inch thumbscrew. By means of a similar screw the end of the side horizontal is fixed to the large upright at I.

The whole framework is thus easily, quickly, and securely fixed to the table, and may, with equal readiness, be detached from it and strapped together into a convenient bundle.

The purpose of small holes bored in the large uprights, as seen at S and T, will be explained in the next section.

For an audience

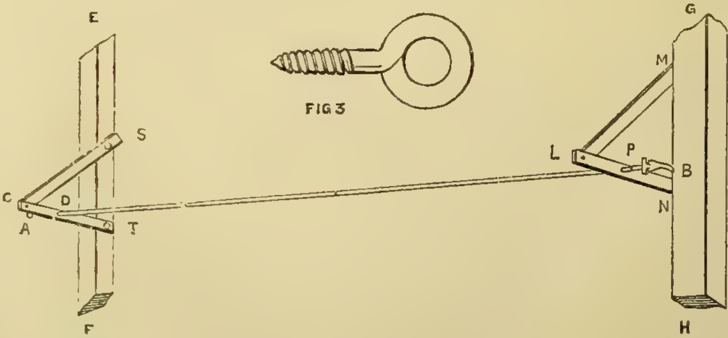


FIG. 2.—ARRANGEMENT FOR LIGHTING.
FIG. 3.—EYE WITH SCREW.

of a hundred or more children, the stage should be arranged on a platform about two feet high. For a smaller audience even, it would be better to slightly raise it, unless the legs of the table are made six inches longer, which however is hardly recommended, on account of the difficulties with doorways already alluded to. It might stand on two low, steady forms, or it is useful to have four blocks of rough deal, each about 7 inches by 5½ inches by 4 inches, for placing under the four legs of the table. I sometimes raise the back legs one inch or one and half inches higher than the front ones, in this case taking the precaution to carry a strong wire from the tops of the main uprights, or from the ends of the large cross-bar, to some fixed points in the rear, so as to prevent the whole structure from toppling over forwards.

2. The Arrangements for Lighting.—Were it possible for the audience to be seated a little *above* the level of the stage, the ordinary arrangement of foot-lights might be adopted, but as it will generally be found necessary, in order that all may see, to raise the stage above the level of the audience, foot-lights and their reflectors would inevitably interrupt the view of the figures. An attempt was at first made to light the stage from the sides, but this was found unsatisfactory, and *head*-lights, instead of *foot*-lights, seemed the only practicable arrangement. It works very well, and while it has the slight drawback of making the wires more visible to keen-sighted near spectators than foot-lights would, it possesses the great advantage of not dazzling and heating the operators. The apparatus which is shown in Fig. 2, consists of (1) a brass gas tube, (2) two iron supports, (3) a reflector, (4) a fire-guard.

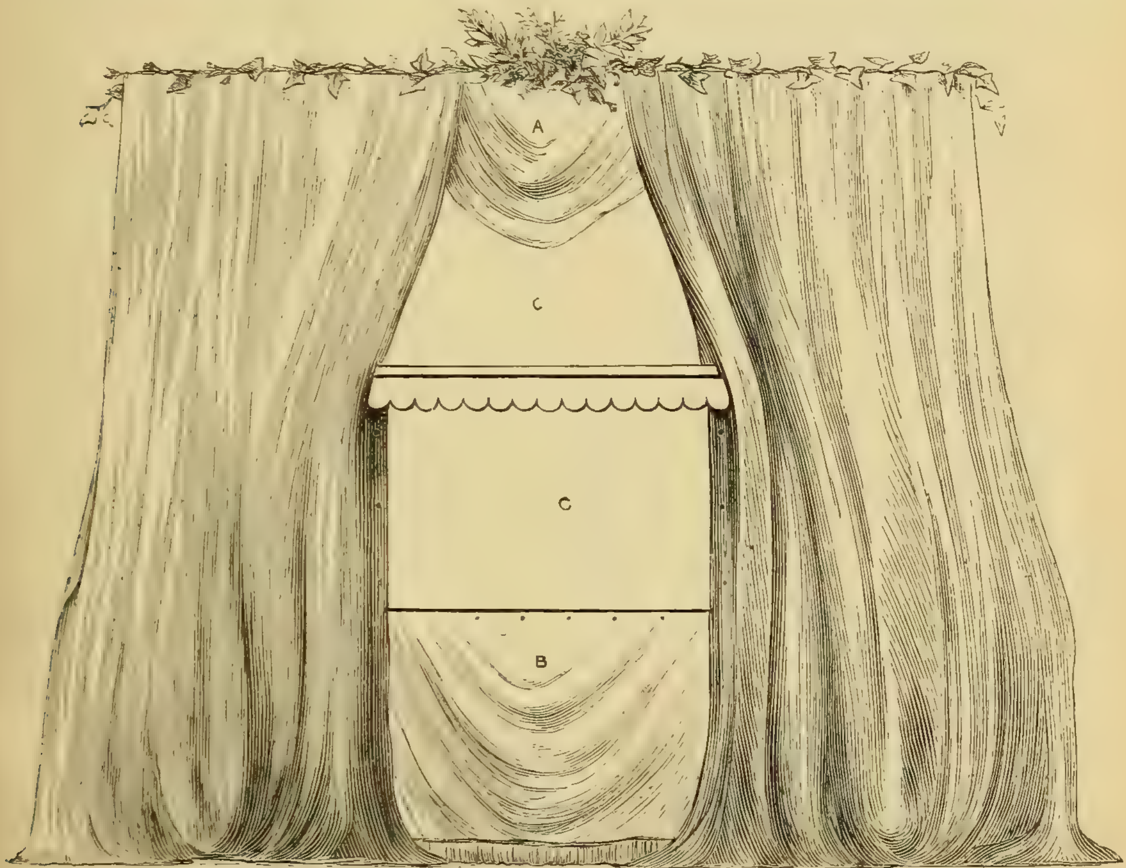


FIG. 4.—FRONT VIEW OF STAGE, SHOWING DRAPERY ATTACHED TO FRAME (A), AND TABLE (B), AND CURTAINS AT SIDES (C, C').

1. A brass tube, ½ inch diameter, 48 inches long, pierced with a row of small holes two inches apart, to within six inches of each end. One end terminates in a simple cap, which may be screwed on and off, the other is furnished with a small tap and elbow, to which india-rubber tubing from a gas branch may be attached. This piece should be made to screw on and off the main brass tube at P.

Should the pressure of gas be found insufficient at any time, the cap at A may be removed and another india-rubber tube fitted on to connect with a second source of supply.

2. Each of the two supports consists of two flat iron plates $\frac{1}{8}$ inch in thickness, 1 inch in width, one 12 inches long, the other $8\frac{1}{2}$ inches, connected together at one end by a pin or rivet, so that they can be shut up or opened to any angle.

At a distance of five inches from the free end of the shorter plate there is a hole into which the brass gas tube fits pretty accurately. Smaller holes in the free extremities of the plates enable them to be firmly fixed by means of screws to the inner sides of the large uprights, as shown in Fig. 2. The lower hole at T is twenty-nine inches above the top of the table; the upper hole is nine inches above the lower one; (see Fig. 1). The screws are of the shape and size shown in Fig. 3, and may be bought ready made.

3. The reflector consists of a piece of wood 46 inches by 4 inches by $\frac{1}{2}$ inch, covered on one side with bright tin. This rests on the supports C S, L M, Fig. 2, and is kept in place by being attached with wire to the rings of the upper screws at S and M. Its lower edge rests at C and L. In this position it should well reflect the light on to the stage, yet not be too much over the jets to get burnt.

4. The fire-guard is very simple, but most important, and consists merely of a wire stretched tightly across from one screw-ring to the other, *i.e.*, from S to M and from T to N. Before adopting this arrangement my curtain on one occasion came into contact with the gas-jets and caught fire. The wire need not be very thick, but should be stiff when in position. Mine is of brass.

The whole lighting apparatus is thus most conveniently portable. The supports shut up into a small compass and go into the tool bag; the brass tube and reflector being strapped up with the wooden framework already described.

3. CURTAINS, SCENERY, AND FURNITURE.—(i.) *Drapery.*—First the drapery of the stage itself, irrespective of any special scenery, demands consideration.

My "drop-curtain" is a simple dark green holland window blind, hung from a roller which rests in the supports at the top of and behind the two main uprights W and X, Fig. 1. It is worked in precisely the same way as such blinds usually are—the cord running over the familiar wheel and rack arrangement, which is fixed to the back of the upright E F, near S. The "blind" should be 44 inches wide, and rather more than $5\frac{1}{2}$ feet long, so that it will come down to the level of the stage. The lath which runs into a hem at the bottom should be somewhat heavy, and quite 46 inches long, so that it cannot come out through the uprights when being worked. (There is no objection to its being even longer, as it has not to pass between the "side horizontals," the bottom of the blind never requiring to be raised so high.)

A pair of curtains about 3 yards long and $1\frac{1}{2}$ yards each in width, will next be required. They are to be hooked on to the wire loops seen in the large cross-bar at the top of the main uprights, Fig 1, and to hang thence to the ground, their inner border being attached to the uprights at two or three points by means of large drawing-pins. Probably, most households would furnish a pair of suitable curtains, without its being necessary to obtain them on purpose.

Two additional small pieces of drapery fastened by drawing-pins to the cross-bar, and to the front edge of the table, respectively, as seen at A and B, Fig. 4, complete in an effective manner the covering of the frame-work of the stage. Great care must be taken to keep the upper piece well out of reach of the gas jets. A strip of thick felt, scalloped at the edge, which hangs down a few inches, must be fastened with drawing-pins to the back of the reflector. The strip should be deep enough (12 inches is ample) to allow of a higher or lower adjustment by turning in or letting out the upper edge. When the stage is much raised the scalloped edge must hang lower than when it is more on a level with the audience. Another narrower strip of thick felt, about 5 inches deep, should be pinned to the rest-bar, to shade the lights from the eyes of the operators, and to help conceal their hands from the eyes of the audience.

The pair of large curtains already described will generally be found sufficient to conceal the operator's movements, especially if they are spread out a little by means of a couple of chairs (as represented in Fig. 4); but, if desired, additional curtains may be hung at the sides on stout wires attached to the extremities of the cross-bar, and carried back thence to nails in the wall of the room or any other convenient points. A few evergreens tastefully arranged along the top will give a suitable finish to the whole.

(ii.) *The Scenery.*—I have found it most convenient to use exclusively textile fabrics, as distinct from paper or pasteboard arrangements. They are extremely effective, and much more durable and portable. For my interior scenes, *e. g.*, the walls of the room are hung with pretty small-patterned oriental cretonne, print, or plain sateen, whilst out-of-door scenes are painted in water-colour on white blind holland. Common paints can of course be used, and they must be laid on rather thickly, as the material is more absorbent than paper. Dark backgrounds

will generally be found best for showing up the figures and rendering invisible the wires.

Each scene requires one back-piece and two side-pieces, which are hung from the back and side horizontals. They must each be exactly 36 inches in depth, the back one 54 inches wide, the side ones 17 inches wide.

Supposing your play requires five different scenes, all five back-pieces may be stitched together at the top, and the two sets of side-pieces similarly treated. The most convenient way of fixing them to the horizontals is by means of a few small screws similar to that shown in Fig. 3, only smaller, which are inserted in metal eyelets let into the upper edge of the curtains. Two such eyelets are sufficient for each side set, and five or six for the back.

The upper edge of the scenes should be even with the upper side of the horizontals. It will be obvious that in order to exhibit any one of the five scenes that may be wanted, it will only be necessary to lift up those that hang in front of it, and let them fall back over the horizontal and hang down behind, the rest-bar being temporarily removed for the purpose and afterwards replaced.

There is, of course, abundant scope for taste and ingenuity in this matter of scenery, and only general directions need be given. For the interiors small-framed pictures, mirrors, etc., may be hung on hooks on the "tapestried walls." A window, fire-place, etc., may be painted on white holland and cleverly stitched to the tapestry, or a real blind and window curtains may be made with silk or satin, and sewn on to the back "wall."

(iii.) *Furniture.* This, too, must be left very much to individual ingenuity, and will vary, of course, with the requirements of the particular play; tables, chairs, cabinets, miniature plants in ornamental pots, etc., being introduced as fancy may suggest. Care must, of course, be taken that the size of the furniture is rightly proportioned to the figures. The same chairs, tables, couches, etc., may be used for different scenes, an appearance of variety being given by different covers being thrown over them, the colour of such coverings being such as will produce a good effect with the rest of the scenery. I made a very useful couch out of a cardboard box, the back, covering and cushions packing up inside it, when not in use. This article of furniture came in very usefully in many scenes, the figures being more easily made to recline upon it than to sit in chairs. A spinning-wheel, easily made to revolve by means of a piece of black cotton wound round the axle, and pulled from the side wings, was very effective. A similar arrangement might of course be applied in the case of a wind-mill or water-wheel.

This reference to out-of-door scenery reminds me that I intended to remark that I am not unaware of the excellent effect which may be given to such scenes by illuminating them from behind as transparencies. Scenes painted, as described, on holland (or on paper) look extremely well so, especially night-scenes, with moon, lighted windows, etc. I have not, however, seen the way yet to overcoming the difficulty involved by the lights and the operators coming in the way of each other. If only two or three figures were on the stage the operators might manage them from the sides, and the light might be thrown upon the back scene by means of a small magic-lantern.

The floor of the stage will not be much seen. I have the wood stained brown, and this serves pretty well for many scenes, but cloths of different colours may be laid down as carpets.

(*To be continued.*)

THE TRAVERSING MANDREL.

By J. LUKIN.

OF appliances for screw cutting in the lathe, there have been but few which have fairly passed the ordeal of practicability. Good in theory, and promising upon paper, they have failed to retain a hold upon the workman, who alone is able to judge fairly their merits or demerits. Broadly stated, the principle of these mechanical contrivances is thus divisible: The work must traverse longitudinally or the tool; the rate of such traverse as compared with that of the work's rotation upon its axis determining the pitch of screw that will be cut. The traverse of the tool has always appeared to the writer more mechanical, and more desirable in a machine than the traverse of the work; but there are special causes in this case which make the latter plan the easier to work out. Of these causes we may advantageously speak briefly, because the ingenious readers of AMATEUR WORK are sure to be trying their hands from time to time upon the *pons asinorum* of screw cutting. Suppose that we have in a chuck such a piece of work as a box, which it is desired to fit with a screwed cover, or that we have any bit of chuck work which can be held without the support of the back centre, requiring a screw to be cut upon it, and that the tool is to be made to traverse longitudinally at a given rate, while the work revolves. Plainly, such tool must be held in some sort of rest if it is not a hand tool (which is the best and most mechanical of all machines to those who have skill enough to use it aright).

Then this rest, or such part of it as holds the tool, must be made to traverse at a given rate. This implies gearing of some sort actuated by, or in connection with, the mandrel, because the speed of the one is relative to that of the other. Such gearing may be by cords or cog-wheels, and here will be found to originate various difficulties and complications. Cords must be kept tight, and need a number of sized pulleys, which again need cords of various lengths, and the utmost accuracy in the size of the pitch pulleys. Such cords are always a nuisance, and the fewer the better. I think I may say that only one man has completely solved, by means of an elaborate overhead, the problem of cutting every pitch of screw by the aid of cords and sized pulleys. This will prove at once the difficulties involved by such contrivances. The alternative is cog-wheels, technically called change wheels. But these are not applicable to ordinary foot lathes without expensive additions, and are what may be called "*a lot of it*"—22 change wheels, a bracket arm or quadrant plate, striking gear of some kind to stop the action in a moment, and all to cut, just now and then, a few turns of screw threads on a box or other simple article. It is cracking a nut with a steam hammer, or slaying a flea with a blacksmith's sledge. I have studied the matter well, and have come to the conclusion that it is far more difficult to arrange the movement of the tool than that of the work, because the latter is the only plan that does not need gearing or cords and pulleys, or some contrivance which, though fairly effective, needs to be lifted on and off the lathe, and requires special fixtures for its support. This is, in fact, the standing drawback to all such appliances.

I shall, however, shortly be in a position to lay before the readers an entirely novel apparatus, which, leaving the screw chaser a hand tool, yet guides its traverse accurately, and is free from the defects named.

The inventor, however, is not quite ready to make the apparatus for sale, and has also simplified it since applying it to my own lathe.

Now, if we are content to use the traversing mandrel, and to make the work traverse instead of the tool, we do away at once with a host of complications. Nothing is more simple, nothing more perfect in action; and it is a pity that lathe-makers have not made this form of mandrel the rule instead of the exception. All amateur's lathes should be so made unless specially ordered otherwise, and if such were the case, the traversing mandrel could be made as cheaply as an ordinary one, and screw cutting would no longer remain the bugbear of the amateur mechanic. It is only because the traditions of the workshop are difficult to eradicate that the old-fashioned "*collar and back centre of hardened steel*" remain in the ascendency.

The mandrel of traversing action is cylindrical from end to end, except that it has a front cone fitting for a short distance a similar collar. This front collar is, in fact, bored out parallel, and then countersunk for a short distance to receive the coned part of the mandrel. In the older lathes, which are unfortunately replaced by those of newer designs, far more costly and not at all more efficient, there were a series of short guide or pattern screws cut upon the mandrel itself, either outside and beyond the poppit, or between the uprights of the headstock. The collar allowed the mandrel to slide freely to and fro, but without slide shake. Underneath the bits of guide screw were a row of half-nuts, of which either could be raised at pleasure into contact with its own guide screw, and as these were fixed, the mandrel was compelled to advance through its bearings at the exact rate of the selected guide screw. A tool held steadily upon the rest, would thus trace on the work an exact copy of the pattern on the mandrel. When such traverse was not required, the half-nut was lowered out of gear, and a catch fell into a circular groove on the mandrel, preventing the sliding motion from taking place. The half-nuts were in reality small blocks of wood raised by wedges, and the screw cut into them by pressure, imprinting their own threads; and it was easy when any of these got worn by frequent use to replace them by new blocks. Hard wood was not so needed for the purpose as that with tough close grain, such as beech, birch, sycamore, etc.

Any amateur within reach of Tunbridge Wells should run down and see for himself how efficient these lathes are; but I may warn him that whereas the mandrel and collar used to be sold separate for fitting into a wooden headstock, he will now find them difficult to procure, and will probably be driven to his own resources to produce them.

This is, as I have been at the pains to record strenuously elsewhere, very regrettable; for if all sorts of pretty work requiring screws is done every day on these lathes at Tunbridge, the same facilities for its execution ought to be supplied to amateurs.

But it will be answered, there are now improved traversing mandrel lathes, quite so—and there are chronometers, but ordinary watches are, I fancy, a little cheaper, and quite as useful for all ordinary purposes.

Some time ago I urged upon the Britannia Company to undertake this work, and to issue lathes with such mandrels at a price to suit all comers. They advertised their willingness to do so if a certain number were ordered; but they reported to me that

there was *no demand.* No, and I can perfectly understand it, because customers—old ones—are supplied with the stereotyped form of lathe, and new ones have no idea of the immense convenience of a traversing mandrel, and will not learn their need of it till too late. But if they were once to become general, the more common form would grow into disuse, except for metal turning, and amateur wood and ivory turners would never hear of purchasing a lathe without this useful appliance. I verily believe that if the Britannia Company had started by advertising that all amateur lathes would be so fitted unless otherwise ordered, they would have realized a large and constantly increasing sale. No amateur who has once tried them would willingly revert to the ordinary form, and if they were to be used generally the price would be no greater than that of an ordinary lathe. That *some* screw-cutting device is needed is evident, for inventive power is ceaselessly at work to devise means for doing with the ordinary lathe what can be so readily done with the other; and, after some apparatus of the kind is fitted, the cost of it would have provided the traversing mandrel in all its beautiful simplicity and efficiency.

The old French and German pattern, which is still in use at Tunbridge, is represented in Figs. 1 and 2, which are identical in principle, but in Fig. 1 all the guide or pattern screws are beyond the headstock, while in Fig. 2 they are within it. In both Figs. A and B represent in plan the uprights of the headstock which carry the collars in which the mandrel revolves and traverses. Fig. 4 is a complete drawing of headstock fitted to the mandrel in Fig. 2, and the same letters designate the same parts of each. D, E, and G represent the short bits of guide or pattern screw of various pitches—one being similar to that by which chucks are attached to the mandrel nose; C is the pulley here represented, with only two speeds, which was usual in old lathes. It will be understood that the two necks of the mandrel are cylindrical, fitted very nicely to the collars, but there is a little cone in front, seen in Fig. 1, to take the pressure when work is being driven into the chucks, or when drilling is carried on. At the left-hand of the mandrel, in Figs. 2 and 4, is seen a groove turned in the mandrel just by the inner face of the poppit head, and into this falls a catch plate, pivoted to the headstock, thus easily retaining the mandrel in its place when not required to

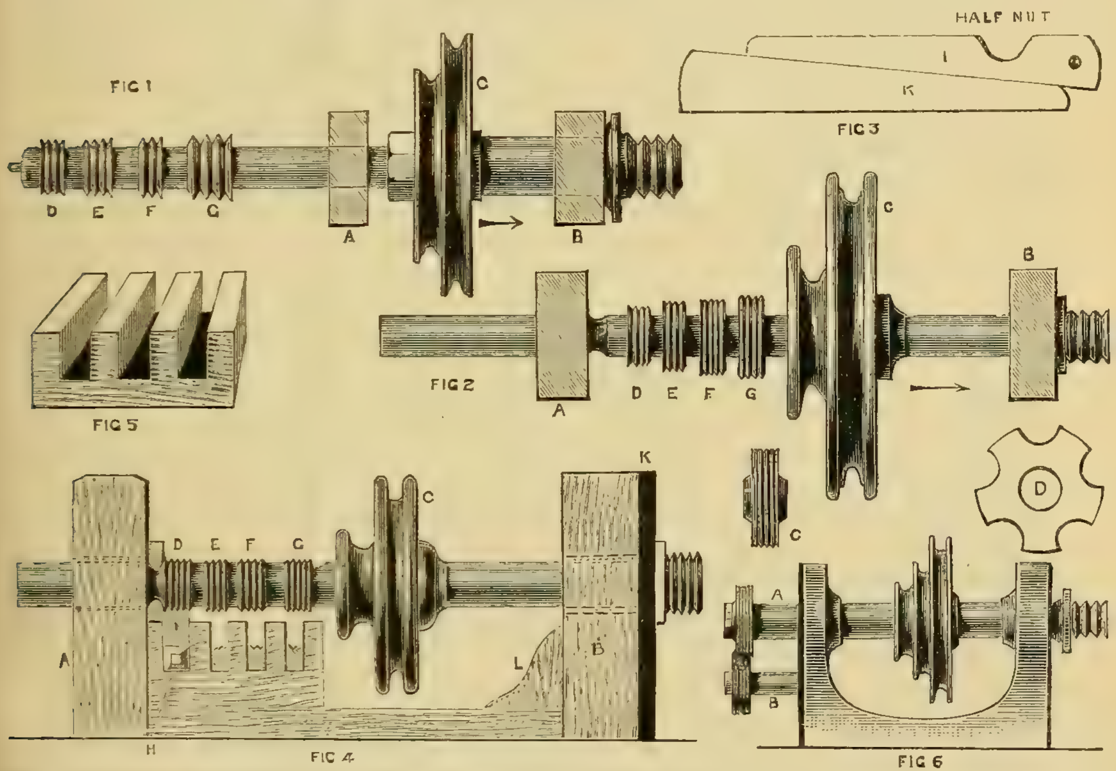


FIG. 1.—GUIDE SCREWS OUTSIDE HEADSTOCK. FIG. 2.—GUIDE SCREWS INSIDE HEADSTOCK. FIG. 3.—HALF NUT AND ITS KEY. FIG. 4.—HEADSTOCK FITTED WITH GUIDES COMPLETE. FIG. 5.—WOODEN BLOCK FOR HALF NUTS AND KEYS. FIG. 6.—MODERN TRAVERSING MANDREL AND DETACHED GUIDES.

traverse The black line, I, of Fig. 4, is the edge of a steel plate screwed to the headstock and bored to take the mandrel. There is a thick boss at the back, also bored and coned—the plate carrying the front collar.

The headstock is made entirely of wood, generally of Spanish mahogany; the uprights being solidly attached by dovetailing to the baseboard, and the front one also further strengthened by an angle piece, shown in profile at L, of Fig. 4. Underneath the screwed part of the mandrel, and attached to the bottom of the headstock, is a block of wood, shown by itself in Fig. 5, with a series of channels cut in it. Each of these channels is of the width, or nearly so, of the guide screw above it. A stout steel wire, which runs through all the grooves, forms a pivot to a row of wooden keys, shown at I, in Fig. 3, in each of which is a semicircular hollow to form the half-nut. Underneath is seen the elevating wedge, H, by which it is raised into contact with the guide screw above it; at H, I, of Fig. 4, the first key of the row is shown, raised in this way. In the first instance, as I have already stated, the hollow or half-nut is plane, and carries no thread, but as soon as it has been wedged up, the screw above indents it deeply, and the mandrel being caused to revolve, at once forms in the wood a reversed copy of its own screw. As soon as such thread is formed, the mandrel will always traverse in its bearings when the key is raised, such traverse taking place, even with a wooden half-nut, with power sufficient for cutting a screw with a point tool or hand-chaser of suitable pitch. It was easy to introduce, as an improvement, keys of brass with well cut thread, but, as a rule, workmen stick to wooden ones.

If the pattern of mandrel (Fig. 1) is preferred, the block of keys and wedges is placed upon a bit of extra bed beyond the headstock. This may, perhaps, be preferable, as keeping the screw-guides away from dirt and shavings; but the other is the more general form. Such was the traversing mandrel of half a century ago, originated on the continent, where it is still in daily use. What are its drawbacks? First, it is somewhat clumsy in appearance; secondly, it is not so durable as an iron headstock; thirdly, the wood may warp a little, and throw the mandrel out of truth. Practically, if seasoned mahogany is used, it is not the least likely to do anything of the kind. Holtzapffel criticizes it as being a compound of wood and metal, for which there seems no sufficient reason; yet observe, he himself specially favours wooden standards supporting an iron bed in all his first-class lathes for amateurs; and in my humble opinion he is right. I leave my readers to judge how far the above drawbacks condemn this old-fashioned lathe mandrel and its fittings.

Regarded from a workman's point of view, this pattern is cheap, easy to fit up, and reliable; and even were he to live to wear out a headstock, he could make himself a new one. The mandrel and collar will no more deteriorate, if well-made and hardened, than that of a 200-guinea one of modern build.

Why, then, are such lathes confined to continental workshops and to the one or two at Tunbridge? Chiefly, I think, because for trade reasons the mandrel and collar which used to be sold separately, so that a workman could build his own lathe, are withdrawn from the market. It is, I suppose, more profitable to lathe-makers to sell a complete machine; but, on the other hand, headstocks are still obtainable in sets to be fitted to home-made bed and standards? and why not this mandrel and its two collars—or the mandrel in a cast-iron headstock and collar, leaving the keys, etc., for the workman to make? —for, observe, there is no advantage in a wooden headstock *per se*, and iron ones are now cheap enough to suit all purses; and gun-metal bushes would answer very well instead of hard steel. All I plead for is the mandrel with four to six pitches cut on it, with its collars, and, if necessary, the headstock. This an amateur cannot make very easily, because the guide-screws must be machine-cut. There need be nothing expensive about the thing—just the headstock made longer than usual, with parallel bushes, and a mandrel accurately fitted. It appears to me that, apart from all else, this need cost no more than one of the mandrels with double cones, so often fitted even to the cheap lathes. The iron beds and headstocks on cast standards are handy and compact; but who has not discovered that a 4-foot bed is too short where wood-turning is much practised, and that even a 6-foot bed, which is by no means usual, is not always sufficient. In point of fact, no wood-turner uses such a lathe, but fits up a long wooden bed capable of taking in a curtain-pole, to say nothing of table legs and bed-posts.

But we will pass on to the modern traversing mandrel. Here it is in Fig. 6. The mandrel, as before, runs in plain parallel bearings of gun-metal or hardened steel, but the headstock is no longer than usual, and is of cast iron, and is well formed and beautifully japanned in the best lathes; and be it understood you can buy none but the best and most costly. The end A of the mandrel, which projects beyond the headstock, is covered by a sleeve or tubular cap when traverse is not required; this cap being secured by a nut and washer or end screw with a large head. The end of the sleeve takes a bearing against the headstock, and prevents the mandrel from sliding forwards. When this is removed, there ap-

pears only a plain cylindrical mandrel, with a small feather or key inserted near the end. The guides consist of a set of ferrules, C, with threads accurately cut on the outside, and after being bored out to fit the mandrel, each has a little keyway cut to fit the key or feather already mentioned; the object of which is to prevent the ferrule from slipping round when in its place on the mandrel. It is secured by the same screw or nut that is at other times used to attach the long sleeve or washer.

At B is a pin or stud fixed on a stout brass plate, which has a short vertical motion by means of two slots cut in it, through which screws with large heads pass, and are tapped into the outer face of the headstock. The plate can thus slide up and down a little way, and is generally actuated by an eccentric cam, not here represented. Upon its stud is placed a segment plate of brass or gun-metal, shown at D of this Fig. 6. In each segmental hollow is cut a series of threads, each of which is the counterpart of one of the ferrules; and when the plate is raised by the cam these segments become the half-nuts, replacing the wooden keys of the older lathes. The traversing action is, of course, precisely the same in both lathes—the work advancing at a given rate while the tool remains in the same position. I believe I am right in stating that the cheapest lathe of this pattern is £40. Hence it is not likely to be met with elsewhere than in the workshops of wealthy amateurs. It is thus that so few have any practical experience of lathes with traversing mandrels. The cheap ones are hardly to be met with; the costly ones are evidently unattainable by the majority, who "willy-nilly" purchase the ordinary lathes with no such facilities for screw-cutting, and then rack their brains to discover some contrivance to supply their need! The fact that there are such appliances brought from time to time before the mechanical world is an answer at once to the question, "Is the traversing mandrel really needed by practical turners?"

There is one point in connection with this subject to which, in concluding this paper, I think it essential to direct the reader's attention. Speaking to a lathe-maker the other day about a novel appliance for cutting screws as a substitute for the traversing mandrel, he asked, "Can a man cut iron screws with it?" Many lathe-makers entertain similar ideas about the traversing mandrel. They see in their own workshops screw-cutting constantly carried on, and get an idea that these are the objects of the amateur, which in nine cases out of ten they are not. Hence I have known an amateur purchase a screw-cutting lathe, for which he subsequently found he had no use whatever, being utterly unsuited for general work in wood. A traversing mandrel is for use in screw-cutting in wood, ivory, and *rarely* in soft brass or white metal. For cutting iron screws it is of no use, and was never devised for that purpose. But a turner finds countless cases arise in which he needs a few turns of a screw thread cut upon his work. In fact, all parts of his work should screw together, instead of being glued or tenoned. All boxes should have screwed lids, especially needle-cases for the pocket; and it is only needed to inspect a shopful of turnery to see articles by the dozen requiring screws, such as can be cut without failure by a lathe with traversing mandrel.

A SMALL CABINET WITH TURNED ENRICHMENTS.

A STUDY FOR AMATEUR TURNERS.

By ALEXANDER MARTIN.

(*For Elevations of Cabinet, and Details, Figs.* 1—4, *see Folding Sheet issued with this Part*).

THIS small cabinet, which is intended to stand on a table, or in some such position, has been drawn to afford the turning lathe some opportunity of getting its work displayed; and, of course, as all the ornamental work about it is turned, the different pieces ought to be as carefully and delicately finished as possible. The general form is such as to constitute an interesting piece of furniture, and at the same time, give easy access to the articles placed in it for examination. The closed part is, of course, intended for delicate work requiring to be carefully kept from dust, etc.

The front and side view, and half back view—the back view being only drawn in half, in order to save space—are all drawn to a scale of 2 inches to 1 foot; and, as a scale is shown, all the measurements can be obtained from it.

The letters attached to the detail drawings of the turning indicate their positions on the side and back views. In construction, the first thing to be done is to prepare the wood required for the turning. The four front posts, marked A on the side view, and the post in each side marked B B, should be dressed up square; they should be about 1 foot 11¼ inches long to allow them to go up to the underside of the top member of the cornice which forms the top shelf, and to allow also for a pin being turned for going into the shelf forming the top of the cupboard. The wood for the vases marked G, is dressed up square too, and allowance made in the length for a pin to go into the top shelf. All the other turned pieces being

round throughout their entire length, do not require to be dressed up square, any rough piece being equally suitable. Frame together the gables of the cupboard, taking the back posts, all the length up to the under side of the top shelf—see back view. Get the back rails ready; two of these are cut out in half circles between each spindle. A simple way to do this, is to take the two shaped rails in one piece of wood, and with a brace and bit, the bit making a hole $2\frac{1}{2}$ inches in diameter, bore six holes up the centre, see Fig. 1; then cut this up as shown by the dotted line. This method will be an immense saving time over cutting out all the dozen half circles with the bow saw, and will make a more accurate curve as well. These rails having the spindles fitted into them are mortised into the back posts. The top of the cupboard, moulded on the edge similar to the bottom or sole, is checked out at the back to fit against the back rail and show on the side view, as if it went right back to the wall—see side and back views. This top, $\frac{3}{4}$ inch thick, may be screwed down to the gables of the cupboard, for the spindle rails which rest on it will then cover up the screw heads. The bottom or sole is put on underneath all, and screwed from beneath.

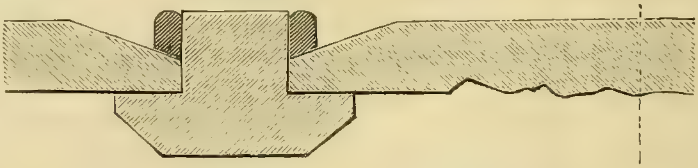


FIG. 6.—SECTION THROUGH CARVED PANEL OF DOOR.

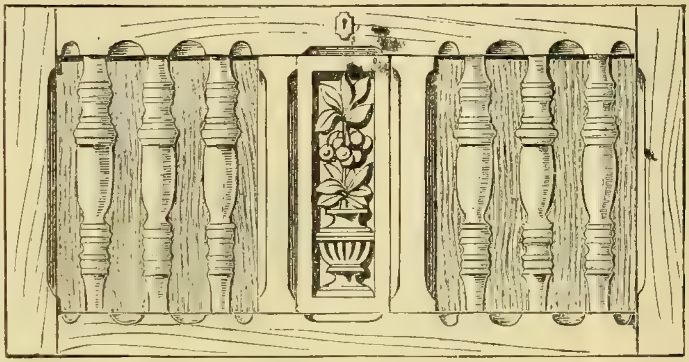


FIG. 5.—ALTERNATIVE DOOR FOR CABINET.

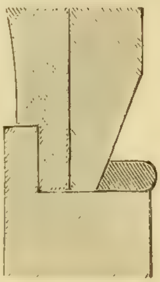


FIG. 7.

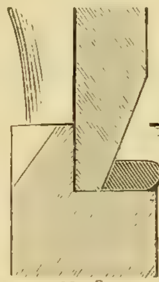


FIG. 8.

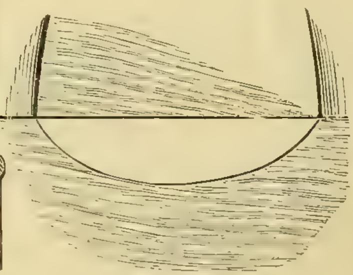


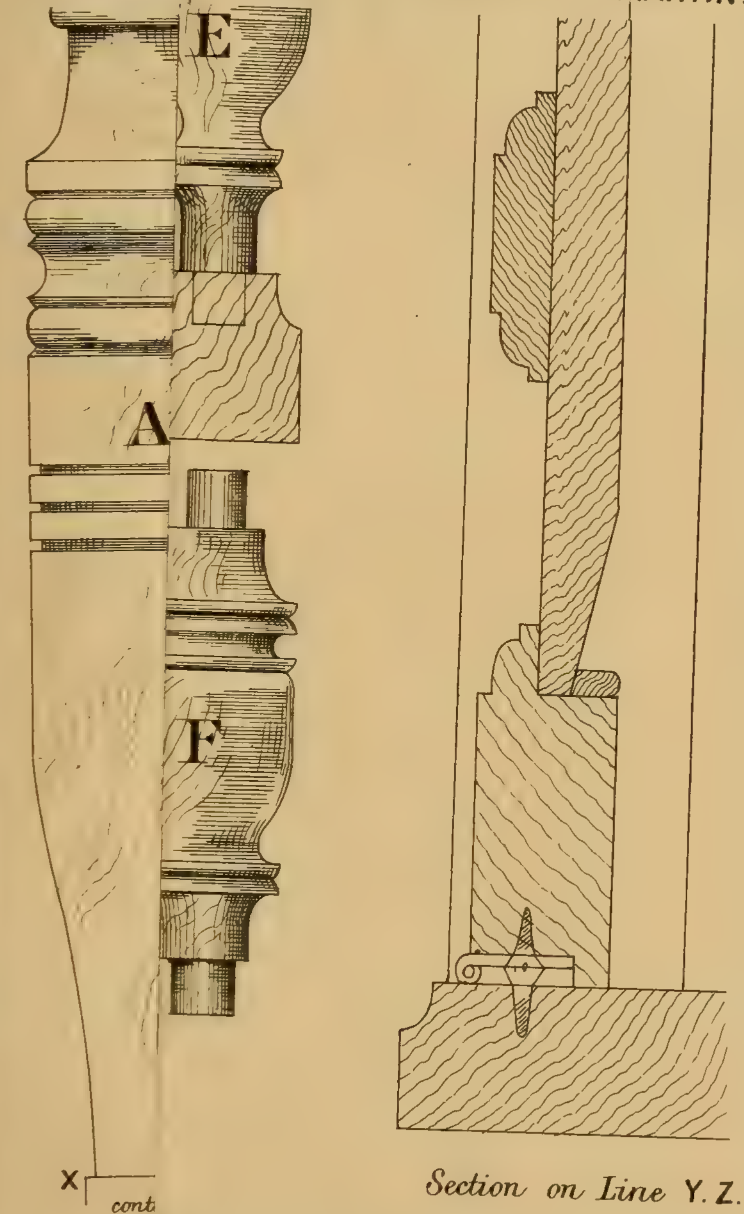
FIG. 9.

FIG. 7.—SECTION SHOWING HOW SPINDLES ARE PUT IN. FIG. 8.—SECTION THROUGH CHAMFER SHOWN IN FIG. 9. FIG. 9.—CIRCULAR CHAMFER BETWEEN SPINDLES.

The spindles marked E are then fitted into their top and bottom rails as shown, which rails are mortised into the front and end posts. Take care to cut the mortises in the centre of the posts, so that the centres of the spindles and the centres of the posts will all be in one straight line. The post, B B, will need to be half-checked $\frac{1}{2}$ inch deep and $\frac{3}{4}$ inch broad, to receive the narrow middle shelf (see Fig. 3), which shows how the shelf is shaped, the dotted lines showing the position of the post. The shaped rails under the cornice are cut out, and it must be noticed that they go up behind the lower members of the cornice, to the under side of the top shelf. This is clearly shewn in the section in Fig. 2, where it is also shown that these rails are put in about $\frac{1}{8}$ of an inch back from the face of the posts. The two half circle shaped rails cannot be cut with a brace and bit, as the other half circles were, for this reason, that for the sake of appearance here it is necessary that this shape be more than half a circle. But as there are only two required, it will not matter very much. These rails being mortised into the posts, the whole is attached to the cupboard and back framing, the pins at the foot of the posts going into holes bored to receive them in the cupboard top. The cornice has to be attended to next; the posts are, therefore, checked at the top down to the surface of the shaped rails, and just broad enough to receive the moulding marked H, shown full size in Fig. 2. This moulding is mitred at the corners and glued on; and the top moulded on front and ends is fixed by screws from below at the fronts and sides, and down from the top into the back rail, the back ledge hiding up the screw heads. The middle narrow shelf $\frac{3}{4}$ inch thick, and moulded on the edge like the bottom is then prepared; the corners are slightly rounded, and it is half-checked into the post B B, see Fig. 3, which is a plan of the corner of the shelf all prepared, the dotted lines showing the position of the aforementioned post, B B, which is checked to

Smal

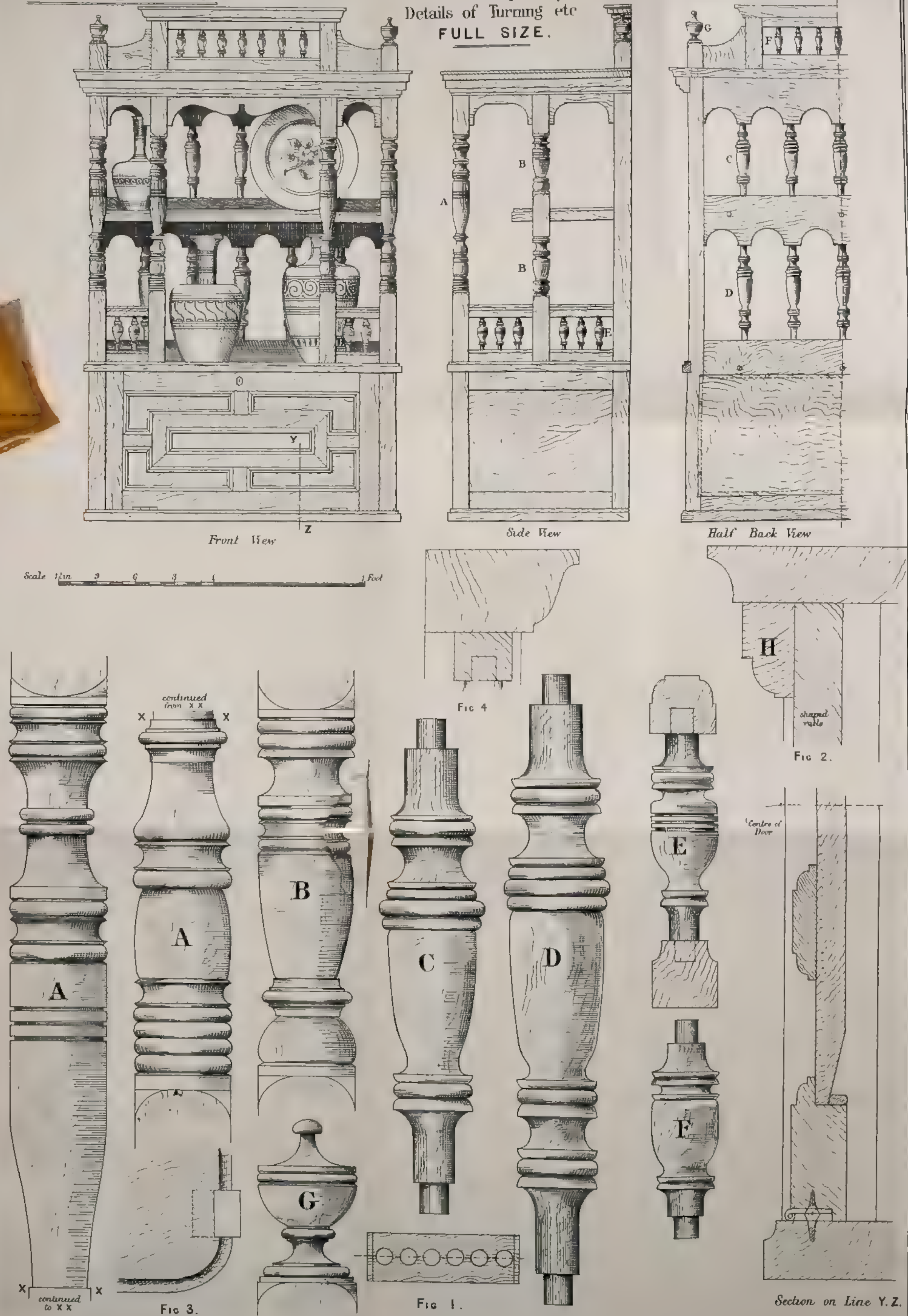
AMATEUR WORK BY A. MARTIN.



Section on Line Y. Z.

AND CO., WARWICK HOUSE, SALISBURY SQUARE, LONDON, E.C.

Small Cabinet with Turned Enrichments. Specially Designed for AMATEUR WORK BY A. MARTIN.



WARD LOCK AND CO., WARWICK HOUSE, SALISBURY SQUARE, LONDON, E.C.

receive the shelf. Some screws from the back into this shelf will then effectually fix it.

The ledge at the back of the top is next treated; the spindles are fixed into their rails by means of the pins turned at each end, these rails are mortised into the square posts, and the shaped rails at either side mortised into their respective posts. The turned vase having a pin on its lower end, will, by entering the top, keep the ledge firmly in its place. On the top of the spindles is glued a cope moulding, a full-sized section of which, along with the upper spindle rail, is shown in Fig. 4. The cupboard wants its back put in. This should be about $\frac{1}{4}$ in. thick, and the dotted lines shown on the back view indicate the check which is formed to receive this back, so that the whole back surface of the cabinet will be quite flat. A few screws will fix it on.

All that remains to be done, is to make the door for the cupboard. Although it is of such an oblong shape, it might be made to open in the usual way, but it has been thought advisable that it should open downwards. If fitted with a brass quadrant, it will form a flat shelf for placing things on as they are taken out of the cupboard. I mention a brass quadrant because it is the best thing for the purpose; but a cord of any sort would do equally well, provided it was of the proper length to allow the door to reach the level, and go no further, and if the cord were covered with silk, it would look nicer than the brass. This cord would be attached at each end with an ornamental brass-headed nail; and, although it cannot be expected to be as durable as metal, it will be more easily renewed. A section of the door is given—see section on line Y Z, where it will be seen that the door is framed up in the usual way with one panel; the imitation framing is planted on this panel, the mouldings all mitreing into each other. In a large door this would be very unsatisfactory, owing to the fact that a large panel always shrinks or swells, more or less, in this ever-changing climate of ours; but the panel under consideration is so narrow, that it will not alter much, especially if a well-seasoned piece of wood is selected for it. Planting this framing on the panel makes as good a job as far as outward appearance goes, and being much easier to make, and having a neater appearance inside when the lid is opened down, is altogether the best way to make it in this case. When the hinges and the lock are put on, something will be needed to prevent the door going too far inwards. A little block of wood is often just glued on to catch the door; but the better plan is to sink this little block into the wood, say $\frac{1}{4}$ inch deep, and when glued in it will never, with ordinary usage, give way.

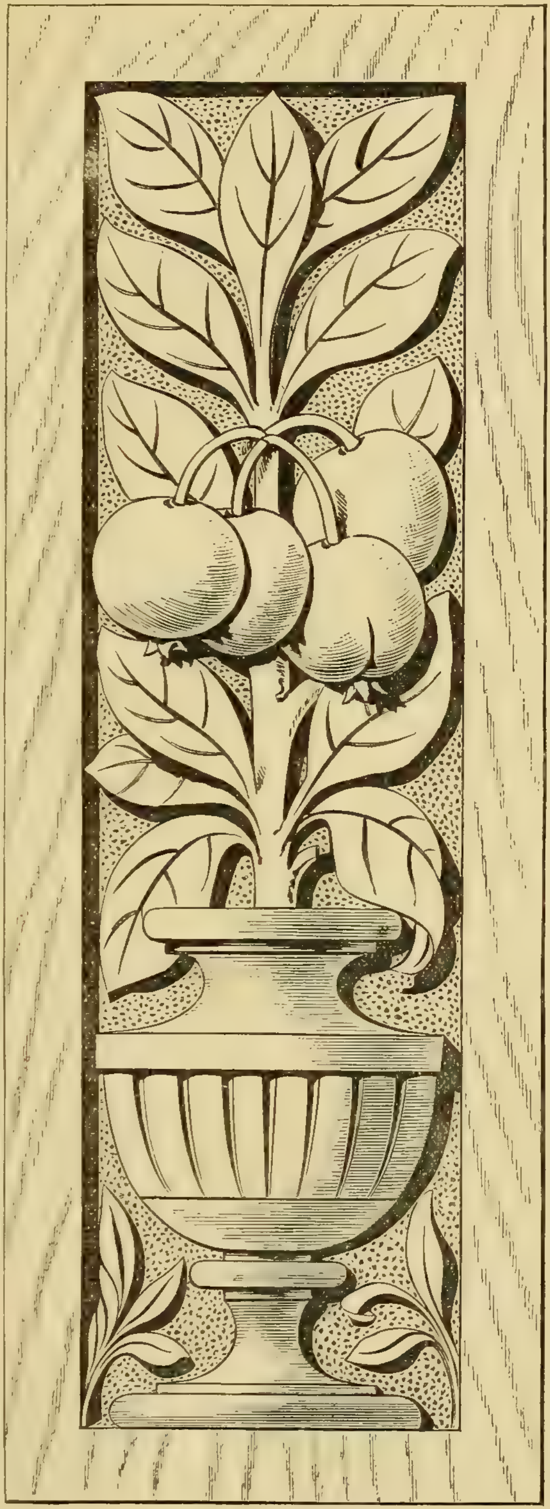


FIG. 10.—DESIGN FOR CARVED PANEL—FULL SIZE.

Some might prefer the alternative door I have

shown in Fig. 5, where turning is introduced. It is formed of three panels ; the centre one is carved, and the side ones have three half spindles planted on them. The upright framing is stop chamfered, and between each spindle is a circular chamfer as shown in Fig. 9. A section through the carved panel is shown full size in Fig. 6, the dotted line being the centre of the carving of which Fig. 10 is a sketch full size. Fig. 7 is a section showing how the spindles are put in, the part cross-hatched being the spindle. Fig. 8 is a section through the chamfer shown in elevation in Fig. 9. The turning of these spindles will be similar to, but a little longer than that marked D in the Folding Sheet, the difference in length being equally distributed amongst the various members. The framing of this door should not be heavier than $1\frac{1}{2}$ inch by $\frac{3}{4}$ inch. Instead of three panels also, the door might have one, and have the spindles continued right across, making nine half spindles in the door.

This cabinet would look well if made of walnut, but, of course, this is a matter that has to be left to the taste of the maker ; only let it be borne in mind that a moderately hard wood should be selected, otherwise some of the sharp corners of the turning would be far too easily damaged ; and even with the greatest care, things often lose their bright, smart, new appearance far more quickly than one would wish.

FRICTION, THEORETICAL AND PRACTICAL.

By F. A. M.

ALL mechanical workers ought to have some notion of the laws of friction. They are very interesting, and are better understood than formerly.

"My lathe runs hard, the mandrel seems at fault." I ask a workman, and he tells me the collars are too long, and expatiates on the easy running of a back-centre lathe as compared with one fitted with two collars. I feel doubtful, and consult an engineering friend, submitting the advice of the workman. "Stupid fellow," says he, "don't know anything of the laws of friction. Why, every text-book you take up will tell you friction is independent of the extent of surface." You still feel doubtful, and perhaps ask why the watch-maker turns down the ends of his spindles so small, and whether a teetotum would spin as well on a flattened point.

I hope enough has been said to induce a desire to read the following remarks, though they do of necessity contain a small amount of theory, which seemed quite essential to the right understanding of our subject. Besides, although we could not possibly do without it, any more than we could do without breaks, or walk always on ice; still friction is one of the greatest hindrances to the success of the amateur worker. If he turns at his lathe it wastes his strength, and if he makes a model engine, 10 to 1 his enemy steps in and holds it so fast that it will not go. Let him then learn something of the nature of his enemy, that he may know how to meet and overcome him.

There appears to be *three kinds* of friction.

1. If a sledge be drawn along a road, what we have to overcome is *solid friction.*

2. If a boat be towed along a canal, or water forced through a pipe, we have to overcome *liquid friction.*

3. If a lathe mandrel, or other shaft, be quickly revolved in well-lubricated bearings, we have yet another kind, which we will call *journal friction.*

It is with this last that we have chiefly to do, but for its proper understanding it is quite necessary that we should treat shortly of the other two kinds.

Speaking generally, there are four causes which determine the amount of friction.

1. The roughness and irregularity, or the perfection and finish of the sliding surfaces. For example, a roughly-turned shaft working in a lathe-bored brass journal will cause very much more friction than a lathe mandrel carefully ground into its collar till both are perfectly smooth and circular.

2. The pressure with which the surfaces are forced together. For instance, friction would be increased if more weight were put upon the sledge.

3. The presence of dirt, dust, on the one hand, or of oil, grease, water, etc., on the other, between the rubbing surfaces.

4. A mysterious adhesion which depends upon the nature of the substances sliding upon one another. For instance, it has been found that an iron shaft will revolve in a brass journal with less friction than in an iron one ; and, generally, there is less friction when the two surfaces are of different materials than when they are of the same.

Taking now the *first* kind or *solid friction*, where one solid moves upon another, with imperfect lubrication or with none at all, it has been found that the power required to slide one body on another depends directly on the weight or force with which they are pressed together ; so that if you were to put twice the weight on the sledge it would require twice the power to draw it.

1. The first law of solid friction then is that friction varies as the pressure. Secondly, it has been found that it would make no difference whether the runners of the sledge were wide or narrow.

2. The second law is that solid friction is not affected by the extent of the rubbing surfaces.

Thirdly, it is found that the power to draw a sledge a mile would be about the same whether the mile were done in five minutes or fifteen—that is to say, the pull upon the traces would be about the same. However, at great velocities friction diminishes.

3. Third law is that solid friction is not much affected by speed.

Turning now to the *second* kind, or *liquid friction*, we find its laws are different. For instance, liquid friction is not affected by the pressure, so that the friction per square foot on the bottom of a barge would be no more than it is near the water line, where the pressure is less.

1. First law, that liquid friction is independent of pressure. Secondly, it is found that, other things being equal, a barge having twice the wetted surface, would require twice the force to draw it along.

2. Second law, that liquid friction varies as the surface. Thirdly, it is found that speed has the most important effect on liquid friction, so that if the speed of the barge were doubled, the tractive force would have to be four times as great, and if the speed were threefold, the force to draw it must be nine times as powerful. Therefore

3. Third law, that liquid friction varies as the square of the velocity.

We come now to the *third* kind, which we have called *journal friction*. Till about two years ago this kind was supposed to be the same as solid friction, and it was this mistake which caused the conflict between theory and practice alluded to at the beginning of this paper. Journals which used to be made one diameter in length were increased to 1½, and in America to 2 and 3 diameters long, in the belief that, whilst their durability was greater, their frictional resistance was not increased.

About two years ago light was thrown upon this subject by some experiments undertaken by the Institute of Mechanical Engineers, and they have proved what might have been suspected before, that journal friction occupies an intermediate position between the other two, following more nearly the laws of liquid than of solid friction. It must, however, be clearly understood that we are dealing only with well-fitted, truly-circular journals, in which there is an equally thick layer of oil interposed between the metallic surfaces all round, and they therefore do not actually touch at any point. The laws of *journal* friction were found to be :

1. Journal friction, like liquid friction, is independent of the pressure.

2. Again, like liquid friction, it is proportional to the extent of rubbing surface.

3. Journal friction is not greatly affected by speed, and does not, like liquid friction, increase as the square of the velocity, but more nearly as the square root of the velocity. It is evident, then, that we must consider journal friction more as liquid than as solid friction, and that the workman who advised reducing the size of the bearings of the lathe mandrel to diminish the friction was quite right, whilst the theorist was mistaken. We can now go on to state several practical conclusions of great importance which were brought out by the experiments.

First, then, as to the pressure on a journal. If this pressure exceeds a certain amount per square inch, the oil will be forced out and the journal will "seize." This means that instead of floating, as it were, on a layer of oil, the neck of the shaft will come into intimate contact with the bearing, the metallic surfaces will adhere, tear one another into deep grooves, developing heat, which heat expands both neck and journal, when, with a horrid noise, the bearing closes upon the neck and stops all further motion. The pressure which oils will bear before being forced out varies much ; naturally a thick grease will bear more than a thin watch oil. Sperm oil, which is very good for lathes and small machinery, will be forced out when the pressure reaches 500 lbs. per square inch ; and, as we might expect, the thinner the oil the less is the friction, and the less the weight it will bear. Here comes in a very important discovery, namely, that if the oil hole be bored through that part of the bearing where the pressure is the heaviest, instead of letting oil in it will let the oil out, and the bearing will only bear, say, 200 lbs. per square inch, instead of 500 lbs., before seizing. An example of this may be seen in the collar of the drilling spindle next the pulley ; the oil boils out at the oil hole next the pulley because the band pulls the spindle up against the oil-hole. This does not occur in the oil-holes of the mandrel collars, because there the lathe band pulls the mandrel downwards, away from the oil-holes, which are here quite properly placed.

Raising the temperature of a bearing has a marked effect on the friction. A rise from 60° to 120° Fahrenheit caused the friction to be reduced to one-third ; probably due to the thinning of the oil by the heat.

This paper may be concluded by a caution. There are in the market many very good lathes made for metal work ; they have good strong mandrels very proper for that work. An amateur wishes to do wood work as well as metal, and to turn wood advantageously you require a speed ratio from wheel to pulley of 8 to 1. If, however, you try to drive one of these metal turning lathes at that rate you will find it terribly hard work. The necks of the mandrel, which work very well and easily at a speed of 4 or 5 to 1, proper for brass, are too large to allow of the speed proper for wood. Examining a lathe by Holtzapffel or

Evans, we shall find one neck of the traversing mandrel about 1 inch, and the other ¾ inch diameter, and about 1 inch long. Here we have a wetted surface in both of 5¼ square inches; putting the belt on the 8 to 1 speeds we shall find these lathes run with such ease and freedom that it is a pleasure to work them. If metal is to be turned it is advantageous to have a strong mandrel, but if it be desired also to work in wood as well as metal, buy another lathe, or be contented with a small metal turning lathe in which the lubricated surface of the mandrel collars does not exceed 6 square inches. It will be understood that it would not do to reduce the bearing surfaces too much, because then the pressure would become too great, and the oil would be forced out.

SOME USEFUL ADJUNCTS TO THE HOME-MADE PRINTING PRESS.

By FAUST.

THE AUTOMATIC PLATEN—SELF-INKING ARRANGEMENT — HOME-MADE ROLLERS — HOME-MADE GALLEYS—WOODEN COMPOSING-STICK.

As readers of AMATEUR WORK who have made a press of the kind described in Vol. V., page 193, may wish to hear how, by a simple arrangement, I caused the platen to rise and fall automatically, and also added a self-inking arrangement for small work, as well as made my own composing-stick and galleys, and cast my own rollers, I have much pleasure in bringing under their notice another article describing these things.

The advantage of having the platen to rise and fall automatically, simply by the action of pushing in and drawing out the carriage containing the forme, will be apparent to all who have made or worked with a press of the construction shown in the previous article. To effect this object, procure two spiral springs about seven inches long, and with a diameter of ¾ inch. The particular kind which I made use of for the purpose are called "loom springs," and may be had from any mill furnishers. Get four stout screw-eyes, put one in the top of each upright a little towards the front of the press, and one in each of the cross-pieces of the platen about ½ inch in from the front edge. Now connect your springs to the eyes, and the arrangement will be similar to that shown in Fig. 1. Your platen should now rise and fall automatically by the action of pushing in and drawing out the carriage; that is, of course, if your springs are of the proper strength. If too weak or too strong, you may have to shift the screw-eyes a little until you get them into a position to suit; but that can be easily done with a little patience on your part.

Now as to the self-inking arrangements, which form a valuable adjunct to the press when doing small work, such as visiting cards, envelope addresses, book labels, etc., although for anything larger it is not of much use, as the distribution of ink for a large forme is beyond its powers. Still, for the small work mentioned it will be found extremely useful, and a wonderful saving of time will result from its adoption, as with the self-raising platen and the self-inking attachment I have printed over six hundred envelope flaps in one hour; when by using the hand roller I could not have done over two hundred in that time.

Get a piece of plate glass 8½ inches long and about 5 inches wide, then take a piece of clean pine wood 9 inches long by 5½ inches wide, plane it up true on the face, strip the edges square all round, and thickness it so that when finished it will be—including the plate glass—1 inch thick. Thus, if your plate glass is a ¼ inch thick, your wood must be ¾, both together making up 1 inch. Fix the glass firmly to the wood by means of cement or glue—Le Page's will do very well; then take off the handle or knob with which you work the type carriage, and glue the piece of wood, with the glass side upmost, to the front edge of the carriage. When the glue is dry put two screws through from the inside to give it additional strength. Now put the knob which you removed on to the front edge of the new piece of wood, and you have an inking table attached to your press, and must turn your attention to the rollers which you are to use upon it.

Two rollers will do, but at present I use three, which I find much better, as they distribute the ink more equally over the forme. Take two pieces of sheet brass (thick zinc will do just as well), and is easier to work than brass, but for appearance' sake brass is preferable. Cut them with a strong pair of scissors or a small saw into the shape shown in Fig. 2. They should be about 4½ inches long by 3½ inches wide, and the slits cut of a width to admit your roller stocks rather loosely. Procure three pieces of stair rod 12 inches long and about ⅜ inch diameter, these are for your roller stocks, wind a piece of thick twine tightly round each stock, leaving about 2 inches clear at each end, this is to cause your composition to adhere firmly to the stock, and prevent its working loose.

Now you are ready to cast your rollers, and for this purpose you must have a roller mould. Go to any working optician, and buy a piece of telescope tubing 1⅛ inch inside diameter, and 12 inches long, examine it carefully to see that the inside is perfectly smooth, if not quite smooth, reject it, as any rough-

ness of the surface will cause a flaw in the roller. Into one end of this tube fit a piece of ½ inch wood, and be sure to fit it carefully, as unless it is quite tight the composition will run out and spoil your cast; bore a hole exactly in the centre, of sufficient size to fit tightly on your roller stock; fix a similar piece of wood to the other end of the tube, but let the hole in it be rather slack for the stock, so that it may slip on easily, then cut a piece off each side of the wood, leaving only about ⅝ inch in the middle, this is to allow you to pour in the roller composition, to the making of which we will next turn our attention, and I may remark that it is a job which demands a large amount of perseverance to get through with, as it is rather "messy."

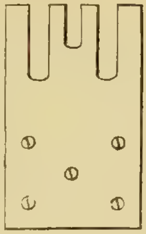


FIG. 2.—PLATE FOR SELF-INKING ROLLERS.

Break up one pound of the best glue into small pieces, soak it in water overnight, in the morning pour off the superfluous water, and put the glue into an ordinary glue-pot, if you have not got a glue-pot take a large jam jar and put it inside a pot of water; allow the glue to melt thoroughly over a slow fire, then add one pound of good treacle and one ounce of glycerine. Boil the mixture for about half an hour, stirring it all the time. While you are stirring the composition your roller mould may be warming before the fire, or in the oven. When the composition is thoroughly mixed, and ready for pouring, put the round piece of wood in the bottom of the mould, stand the mould upright upon a table, put in one of the roller stocks, and put the top piece of wood on to keep it in its place in the centre of the mould; now pour in your composition, very slowly, until the mould is quite full, let it stand for about at least eight hours, then take out the roller and cut off the superfluous composition from the ends, leaving about eight inches of roller in the middle of the stock. You may now proceed to cast your other two rollers in the same manner; after standing a day or two to firm they will be ready for use. You can cast your hand-roller in just the same way, only it should be about 6 inches long by 2¼ inches diameter.

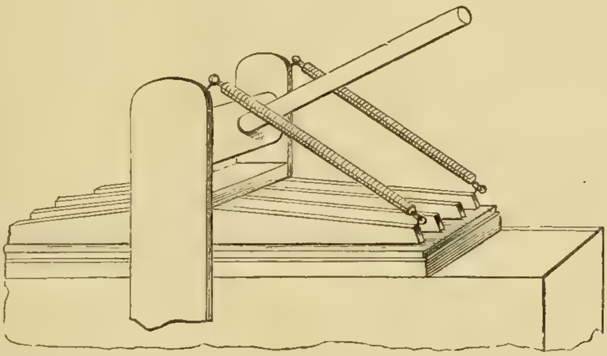


FIG. 1.—DIAGRAM SHOWING PLATEN OF PRESS SHUT AND THE SPRINGS IN POSITION.

Having your rollers ready for working, lay them on the glass inking table, and push in the carriage, then screw on the pieces of brass plate to the side of the press stand, in such a position that the platen will just clear the inside roller. Put a little ink on the glass, distribute it evenly with the hand-roller, put on your self-inking rollers, let the top one rest loosely on the other two, and you are now ready for work.

When your rollers are not in use, you should keep them in the drawer of the press, fitting in two pieces of wood for the purpose of resting the ends of the stocks on, and so keeping the rollers clear of the bottom of the drawer, as if laid down on a flat surface, their own weight would speedily flatten them out and spoil them, and if left out exposed to the air, they would harden on the surface, and become useless for good work.

The making of his own galleys will be found to be quite an easy task for the average amateur, and in making them he will effect a considerable saving, as the material for a 26-inch slip galley will only cost about one shilling, while most printer's dealers charge 4s. 6d. and 5s. for the same size. Get a piece of zinc 26 inches long and 6½ inches wide, bore a series of holes along each side and across one end, about ¼ inch in from the edges, countersink them to receive screw heads, take two pieces of 4-em furniture cut to 26 in. long, screw one piece down each side of the piece of zinc, and one piece 6½ in. long across one end, checking the pieces of wood into each other at the corners, so as to give more strength and finish, and you have now a slip galley equal to any one you could purchase. Different sizes of galleys can be made in the same manner to suit your own special requirements. The zinc may be purchased from any plumber, and the 4-em furniture from a dealer in printing materials.

We come now to the making of one of the most important tools which the printer uses, viz., the composing-stick. This article, although called a stick, is generally made of gun metal or iron, although in some news offices wooden composing-sticks are used, but they are fixed to the width of the newspaper column, and cannot be shifted to any size wanted. Now our stick must be made of wood, so as to

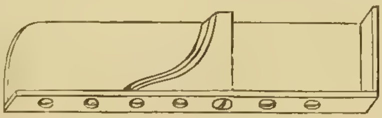


FIG. 3.—WOODEN COMPOSING STICK.

allow of its construction by an amateur, and it must be capable of being shifted to different measures, so as to be useful for any size job required. These conditions the stick now about to be described fulfils; and if well and carefully made, there is no reason why it should not prove quite as serviceable as an expensive iron one.

Plane up a piece of mahogany 9 inches long, $2\frac{1}{4}$ inches wide, and $\frac{1}{8}$ inch thick; a piece of a cigar box will do very well for this. Along one side of this piece glue another piece, the same length, inch wide and $\frac{1}{4}$ inch thick, this piece is to be glued on edgeways to the other; take another piece 2 inches long, $\frac{5}{8}$ inch wide, and $\frac{1}{2}$ inch thick, glue it across the end of the flat piece, as shown in Fig. 3. When the glue is dry, bore a series of holes $\frac{1}{4}$ inch in diameter along the centre of the narrow piece at the bottom of the stick; square up a piece of wood for the shifting end, 2 inches long by 2 inches wide, and $\frac{5}{8}$ inch thick, cut it to the shape shown in the figure, and bore a hole in the lower edge into which insert a stout round-headed screw nail, lay the sliding-piece on to the composing-stick, pass the screw through one of the holes in the bottom into its place in the sliding-piece, and screw tight up; a washer between the screw head and the wood would be an improvement, and prevent injury to the wood. Now give your stick a coat of oil or varnish, and it is finished and ready for use. If you like to spare the time, you can line the inside edges with a slip of thin brass, which will still further augment the accurate and lasting qualities of your stick.

I think a reference to the various figures will make the foregoing instructions pretty clear, but if they should not, I shall be happy to answer any queries which may be put upon the subject.

Just a few hints in closing as to a few shifts and expedients which may be useful to amateur printers. A perfectly flat imposing surface is a luxury which those whose pockets are light cannot afford to get, but they can find a perfect substitute for one by using a square of thick plate glass; do not buy a new piece, a piece of old mirror, or of a broken shop window will do, and these may be found in many glaziers' shops at a very low price indeed.

Another useful wrinkle is to stretch an indiarubber band across the platen in such a position that it will just allow the edge of the paper you are printing to slip under it, it keeps the sheet perfectly flat, and obviates all danger of "slurring." Sometimes a small forme may be wanted for use again, or it may not be convenient to spend time in distributing it when taken from the chase, just slip a strong indiarubber band round it, and put it away till wanted again; it is much handier and better than using page-cord, or leaving the job loosely lying on a galley. Use paraffin oil to clean your rollers, ink-slab, etc., you will find it to be a wonderful cleanser, and much handier to use than the lye, and it does not injure the skin of the rollers.

Let cleanliness prevail in all your work, and avoid slovenliness; put away no article in a dirty state, and so doing, you will find more satisfaction in your work, and be better able to turn out a job in every way creditable to an "amateur printer."

PRACTICAL SCENE-PAINTING FOR AMATEURS.

By HENRY L. BENWELL.

XX.—Set Scenery—How to Paint and Arrange the Set-pieces for an Exterior Set-Scene—Stage Cloths and "Sand" Cloths.

UNTIL recently the exterior scenes in a country theatre were of the most simple description, consisting merely of a landscape back cloth and a few pair of tree wings on each side of the stage. Now and then a cottage door or a porch would be thrust on the stage, and set in a most awkward fashion.

Set-scenes were evidently avoided in the Provinces on the score of expense and the scantiness of the stock scenery at the manager's disposal.

Now, however, everything is altered; and unless a piece is *staged* well it will not go down with the audience, no matter whether the actors be amateur or professional. Indeed, at the present day, all exterior scenery is mainly composed of a series of set-pieces artistically painted and arranged upon the stage with all due regard to colouring, perspective, and effect. By this means of arranging scenery it is possible to place upon the stage a perfect, agreeable, and natural picture, and which gives, moreover, ample facilities for the natural entrances and exits of the performers. We also get in a set-scene a much better effect of distance than it is possible to obtain in a perspective landscape painted entirely upon a back cloth.

Set scenery in some shape has always been in vogue on the London stage, from the days of Sir William D'Avenant upwards; indeed, the pictorial illustrations to the old Court Masques, which owed all their splendour to the inventive genius and artistic taste of that king of architects, Inigo Jones, were composed of solidly built set-pieces, costing, as they did, vast sums of money, and the employment of many hands—artists and carpenters.

The set scenery of the old Dutch stage, some

hundred and fifty years ago, was simply marvellous,* which proves that scenic display was as deeply studied a generation or two ago as it is to-day. We must not forget the Italian stage in considering the present subject, seeing that most of the work was originated and executed by artists of that nationality.

Coming to the more practical part of our subject, we should say at the outset that it does not do to execute scenes on a too extensive scale for the amateur stage, or, in fact, any small stage. We have in previous chapters alluded to the ill effects which arise to amateur actors when the stage room is overdone with scenery and properties.

When a professional man is called upon to furnish scenery for a new play, in which a large amount of scenery is required—probably extensive set-scenes—he goes about his work in a very methodical manner, in a way, we may remark, very different from which the amateur, in his hot haste, rushes to accomplish some new idea or undertaking. It would therefore be as well, and, perhaps, prove of immense benefit to the small (but, we trust, ardent and select, for that will compensate our feelings somewhat) circle of readers who, we are afraid, are really practically interested in this subject, if we give them some idea of how some of our best men set about their work, from getting out their designs to setting their work upon the boards. Be our readers large or small, however, it will no doubt prove instructive and interesting to the general and practical reader alike, and both will understand that the foregoing remarks are not written in a serious vein; they are, in fact, a sly hit at the very few queries that are now received on the subject of scene-painting. This cannot be because the instructions are too clear and easy to follow, as one correspondent lately remarked. This is hard to believe, and, if true, we are half inclined to be less explicit in future, so that now and again we may have a few questions put to us, a thing we are indeed fond of above all else.

This digression, however, is hardly parliamentary, so we may state that the first thing the scenic artist does when he takes in hand a new piece, is to carefully read over the author's manuscript, minutely noting in each scene where anything *practicable* is required, such as doors, windows, steps, waterfalls, bridges, trees, rocks, etc. This is important, because anything required to be used by the performers during the action of the piece, must be built, and sufficiently strong to bear one's weight. For an instance: In Mr. Hamilton's play, "Harvest," in Act I. are some steps cut in the rocks; as the actors have to use these, it would be ridiculous for the artist to paint them on the back cloth, so they are "*built out*" set-pieces, and are of course, marked in author's "plot" as *practicable*. By the author's "plot" I mean the written description of the scenery as it comes from the author's mind, and frequently handed by him to the artist. There may also be a rough ground plan or scene plot similar to Fig. 99. Having read the play, and being furnished with full particulars from both the author and manager, the artist gets out his coloured designs; if satisfactory, he proceeds to make a cardboard model, drawn to scale and carefully coloured. This is set upon an exact model of the stage, and awaits the manager's approval. If satisfactory, the model is passed on to the head-carpenter, who prepares everything for the artist, either in making new flats, cloths, wings, etc., or in altering and adapting some of the old stock to present requirements. The scene is then painted, and finally arranged upon the stage under the direction and superintendence of all parties concerned. In some cases, as in the Lyceum "Faust," views of certain localities are required by the manager. The artist has then to visit the identical spot and make sketches from nature. Mr. Telbin went to Nuremberg, at Mr. Irving's request, to get his subjects for this play. After the artist has completed his first design, he often has to consider how and where it is best to divide his set-pieces from the cloth, and one from another. This requires most careful consideration, and some practical experience, or the result may possibly be to spoil instead of improve the picture.

The subject chosen to illustrate the present chapter, is the "set-scene" used in Acts I. and III. of the American comedy "My Sweetheart," made famous by Miss Minnie Palmer. As this piece is being played all over the country, most readers who have not already seen the play, will be able, sooner or later, to see this identical scene set upon the stage. Of course, it will vary a little from the original in all provincial theatres, but still the scene must be set somewhat similar to the accompanying design.

Considering for a moment that Fig. 111 is an artist's original sketch for a new scene, it will, perhaps, be best to show by way of illustration, how this particular subject can be produced on a most elaborate scale, and rendered extremely pretty and effective. This is accomplished by increasing the number of set-pieces, and diminishing the matter on the back cloth. We merely paint on the cloth the small portion of sky that is visible, and the bit of hazy foliage in the extreme distance. The foliage on each side, and the waterfall in the mid-distance is one large set-piece, whilst the bridge is made "practicable," and built just behind this set-piece. When an actor walks

* A small collection of old Dutch theatrical prints, showing all the scenery, is in the possession of the author, and bearing date 1740, testifies to this fact.

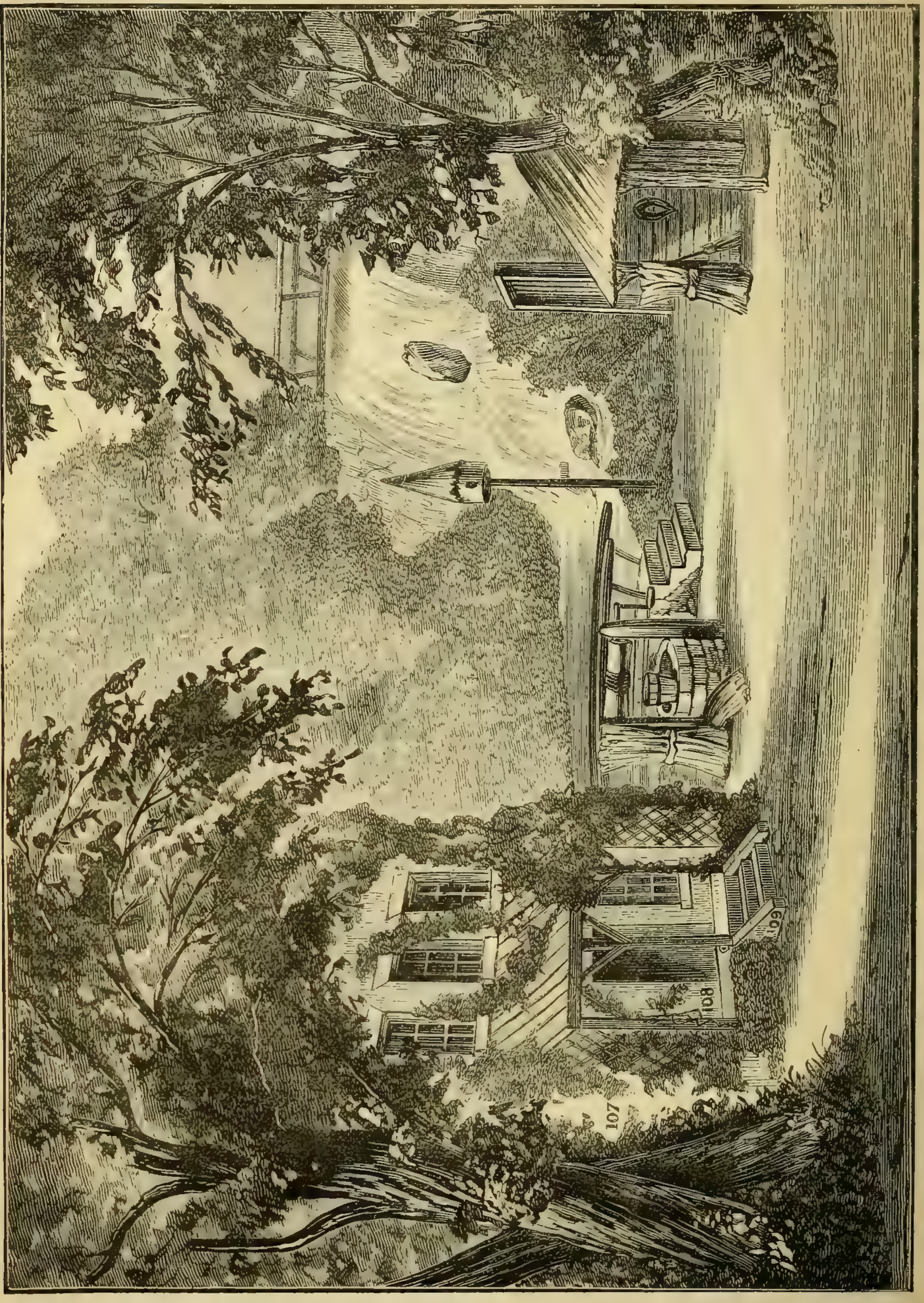


FIG. 111.—SET SCENE IN "MY SWEETHEART," PUT ON THE STAGE, FOREGROUND REPRESENTING STAGE FLOOR COVERED WITH "STAGE CLOTH," AND "SUNSET EFFECT" THROWN FROM BEHIND COTTAGE ON LEFT OF SKETCH (RIGHT HAND ON THE STAGE).

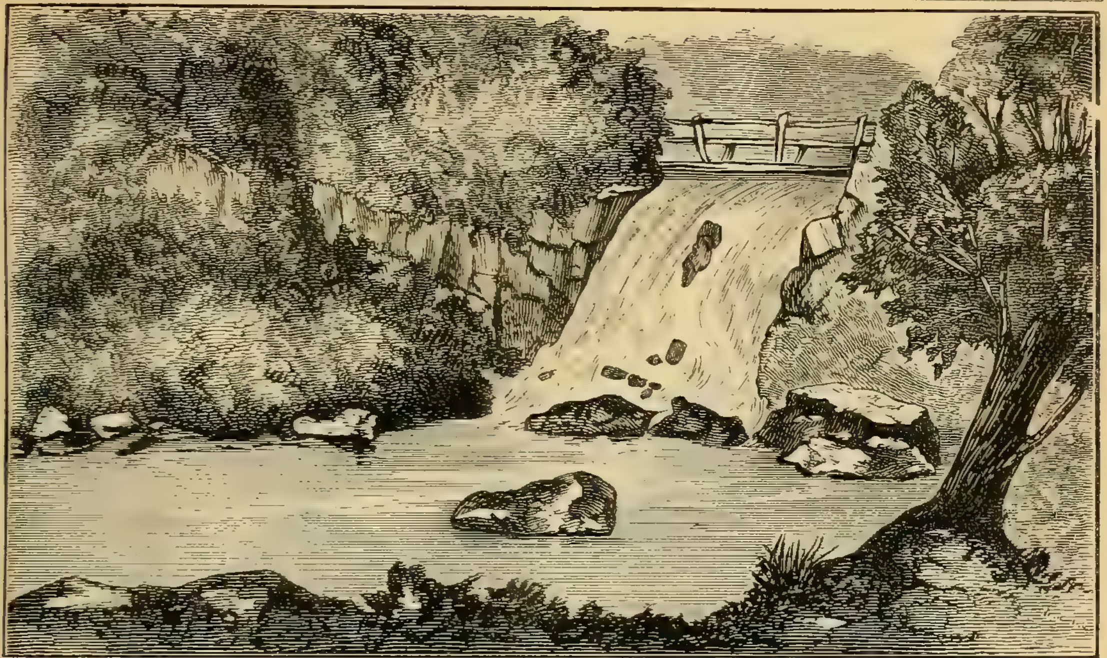


FIG 101

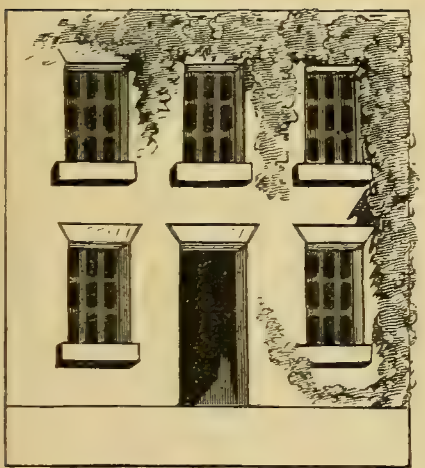


FIG 106

FIG 107

FIG 110

FIG 103

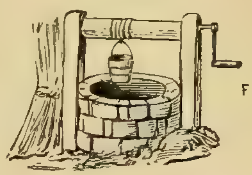


FIG 105

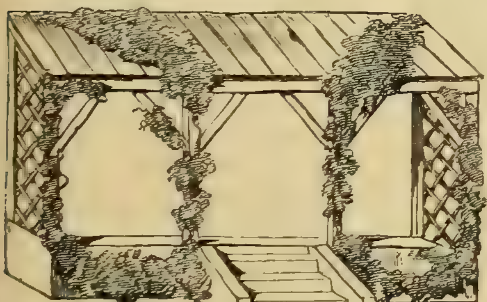


FIG 108

FIG 109

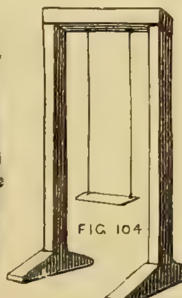


FIG 104

FIG 102

FIG. 101.—BACK CLOTH FOR SET SCENE. FIG. 102.—BRIDGE. FIG. 103.—DOVECOT. FIG. 104.—SWING. FIG. 105.—WELL. FIG. 106.—HOUSE PIECE. FIG. 107.—SIDE WING. FIG. 108.—BUILT VERANDAH. FIG. 109.—STEPS. FIG. 110.—OUTHOUSE OR SCULLERY.

over this bridge, and then a minute later makes his entrance on the stage over the lower bridge, what can be more pleasing and natural from an audience point of view? The water can be made to work to resemble the real thing, or if preferable, water itself may be used. This arrangement, however, necessitates a zinc gutter or channel with a trough on the stage, and also delivery and out-let pipes, besides a good pressure of water from the hydrants. There is a machine used for obtaining the effect of moving water, which will be described in some prospective papers on "stage effects."

The back cloth proper for "My Sweetheart" scene is at Fig. 101. The bridge (Fig. 102) is solidly built of wood and afterwards painted. The steps should be made separately. The dove-cot (Fig. 103) is also of wood, the top part being either modelled in *papier maché* or painted in perspective on some "profile." The swing (Fig. 104) is also strongly made and fixed to the stage, as it is in frequent use during the action of the piece. The well (Fig. 105) is "practicable," the round brickwork being canvas or millboard, tacked on a circular frame. The house-piece (Fig. 106) has a doorway in centre. The side wing (Fig. 107) being also a part of it. It will be noticed that the doorway in Fig. 106 stands some distance from the ground, this is to bring it up level with the built verandah (Fig. 108.) The steps (Fig. 109) are a separate arrangement. Fig. 110 is an outhouse or sort of scullery, and is made of a series of frames with a practicable door. This and the verandah are both made to fold up or to be quickly built up, and as quickly pulled to pieces, otherwise they would not often find storage room during their temporay disuse in Act II. This fixing together and detaching of several parts of a set-piece is an important matter, and most of the stage-carpenters have dodges of their own, some of which will be described, should any papers on stage-carpentry appear. The bundles of straw, brooms, pans, butter churn, horse's collar and buckets, are the real things or properties. They are only shown in the separate pieces to give a clear idea of where they are generally placed. On the other hand, in the finished picture (Fig. 111) which shows the scene set upon the stage, there are several properties omitted in order to keep the scenery from being hid too much. The trees, right and left in the foreground of the subject, Fig. 111, are usually the ordinary tree wings in the first grooves. They may also be set-pieces, the upper branches modelled, and with artificial leaves, etc., on wire. This scene may be adapted to suit the requirements of very many plays—in fact, each set-piece is a very useful adjunct to both the professional and amateur stage.

"*Stage Cloths*."—In all exterior scenes, it is much better to have the bare boards of the stage hidden from view. It has always been our opinion that the floor of the stage with its numberless traps and "cuts" should never be exposed to view, except when absolutely necessary; that is, when the traps, etc., are required to be worked. It completely spoils all illusion or attempts at realism; but on the contrary, gives to the whole a most prosaic and unnatural appearance. In all good theatres, and especially in scenes of an elaborate nature, the manager makes use of a "stage" or "sand cloth." A *stage cloth* can be painted to represent a gravel ground, a grass plot, or a road or "pitched" street. If the latter is required, the old-fashioned style is the best to represent, *i.e.*, those paved with rough and irregular stone flags or the large pebbles, still so familiar to the Liverpool back streets. These "cloths" are generally a continuation of the foreground on the back cloth.

A favourite subject with professionals—if subject it can be called—is to represent a plot of grass, or lawn, intersected with a winding gravel path. In appropriate positions on the grass are placed some built property, flower-beds, with real or artificial flowers; and against the wings, some evergreens and shrubs in pots. Real ivy can be used to great advantage in some scenes, one of these being Fig. 111. Another plan is to represent a rough or stony ground or beach, with shingles and shells. This is the style of thing shown in Fig. 111. The only colours used are yellow ochre, burnt sienna, and two shades of a bluish-purple tint, all the colours being pure, and used with strong size. It will be noticed that the *stage cloth* in this instance is judiciously shaded to match the scene. The lime-light is supposed to be at work behind the cottage piece on the left of the sketch (Fig. 111) and throwing a sunlight effect on to the stage. The "*cloth*," being shaded, considerably heightens this effect, and helps to put the finishing touch to a very pretty picture.

The manufacture and painting of *stage cloths* is a comparatively easy task. The material is the strongest flax, sail canvas, with all the seams sewn with a stout thread or a twine, known as "outwalling" to sail makers. All the seams overlap each other, and are sewn twice, a process known as "herring boning," or "herring boned." These cloths, when not in use, are folded up, or put on a roller, but in order that they shall not crack, the artist uses no whiting whatever. Instead, he uses very strong size, and works his colours well into the canvas; in fact, he rather stains or dyes it, and does not paint.

A *sand cloth* is the article most commonly used in the Provinces, in this instance the only colour used is ochre, worked thoroughly into the canvas with strong size, the workman using plenty of colour. Some artists prefer to use oil colours or "flatting" for these cloths, and many more use this in painting

geometrical patterns of a tiled floor or mosaic work pavement. Canvas treated in this way soon wears shabby, cracks, and it has been said to rot the canvas. On this point I offer no opinion.

(*To be continued.*)

THE MAGIC LANTERN:

HOW TO MAKE IT AND USE IT.

By A PRACTISED HAND.

II.—THE CONDENSER—THE OBJECTIVE—THE LAMP.

WE must now turn our attention to the lenses: these consist of a condenser and an objective.

The Condenser may be single, double, or triple. It is inserted in the lantern front between the source of light and the slide, and is used for the purpose of collecting or "picking up" the rays of light, and transmitting them through the slide to the objective. The common "bull's eye," or plano-convex lens, is the simplest form of condenser, and is used in small cheap lanterns, but will not do for our instrument, as it is of long focus, and has many other disadvantages which I need not particularize. We require a combination of two lenses or double condenser, as it is called. Various combinations have been tried, and it is still a question which is the best. That generally used was first recommended, I believe, by Sir John Herschel many years ago, and consists of a meniscus, A, Fig. 11, and a bi-convex, B, turned as shown in the figure. It is put into the lantern with the meniscus towards the light. A cheaper, and, I think I may say equally serviceable, condenser is a combination of two plano-convex lenses mounted with the convex sides together, as in Fig. 12.

If the amateur intends to grind his own lenses (which I do not advise him to do), he should select the best white flint glass, and he will find the latter combination the easier to make of the two. It is not necessary, nor, indeed, desirable to enter into particulars on the grinding of lenses, in this series of papers. Good condensers can be purchased at many opticians' for a few shillings. They are mounted ready for use in brass cells or holders.

The standard condenser is the four-inch, which, as I said before, is the one we had better use in our lantern. Many exhibitors have adopted $4\frac{1}{2}$ inch and 5 inch condensers, which are, of course, superior for some purposes, but, practically speaking, we should not gain much by using them. The usual focus of 4 inch condensers is $2\frac{1}{2}$ inches. I may mention that it is not as essential to have first-class condensers as it is to have first-class objectives. Marks, such as scratches or *striæ*, on the condenser are not of much consequence. In mounting lenses in the holder or cell, care should be taken to mount them loosely. Many lenses have been cracked by being mounted too tightly. Condenser lenses especially must be loose in the cell to allow for the expansion and contraction of the latter caused by its proximity to the lamp.

Triple condensers have not come into general use though they possess some advantages over the double ones. But as they are dearer and bulkier, and as either of the above two-lens condensers will answer our purpose, we may be satisfied with one of them. In case, however, some of my readers should wish to try a triple condenser, I give two combinations for them to select from; both have been found to answer well. The first is the Herschelian combination of a meniscus and a bi-convex, mounted with a smaller plano-convex lens in front of the meniscus. The plano-convex lens is nearest to the light, the convex side being turned to the meniscus. The second combination is that of three plano-convex lenses, two mounted as in Fig. 12, and the third interposed between them and the light. The object is to shorten the focus, and so enable the condenser to pick up more of the rays of light.

The Objective magnifies the image of the picture, and projects it on to the screen. Everything, I may say, depends upon the objective, and if it is not a good achromatic combination of lenses we shall not obtain anything like satisfactory results.

The photographic portrait lens may be adapted to the lantern, and if a good lens will answer well. The screw ring or flange of the lens must be fitted into one end of a brass tube $3\frac{13}{16}$ in. in diameter by $2\frac{3}{4}$ in. in length. This tube slides into the front tube, Q, of the sliding front of the lantern; it should slide freely within the tube, but must not fit too loosely.

The merits of an objective may be determined by noting whether it is perfectly achromatic, whether the picture projected on the screen is free from the defect of distortion, and whether, when correctly focussed, the picture is equally—or, any rate, nearly equally—sharp all over. The defect of chromatism, shown by the presence of a coloured band along the edge of the disc on the screen, is a most serious one, and should not be seen with any good lens.

An objective that has been much used in some of the cheaper lanterns is a combination of a meniscus and a bi-convex. If the amateur intends to make his own objective, this is the combination that will recommend itself to him. The bi-convex is turned inwards, that is to say, towards the slide, and the meniscus is mounted quite close to it, with its con-

cave side out. A diaphragm or stop, that is, a disc of cardboard or thin metal blackened on both sides, with a small circular opening in the centre, must be inserted in the tube a short distance in front of the outer lens. The object of this diaphragm is to give equal definition all over the picture by cutting off all the outer rays of light. As a general rule the smaller the aperture of the diaphragm, the clearer the edges of the picture; but, of course, this sharpness is only obtained by sacrificing a good deal of light, which, I need not say, is not at all desirable. The size and exact position of the diaphragm must be determined by trial.

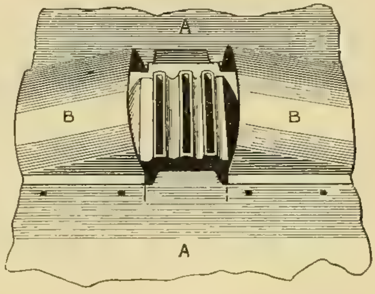


FIG. 18.—BURNER FITTED TO DOME.

The Source of Light.—Mineral oil lamps with two, three, four, and even five wicks, are used as a source of light for the magic lantern. We will be satisfied with a three-wick lamp. Indeed, there is not much to be gained by using a lamp with more than three wicks, for though a four-wick lamp may give somewhat more light, yet there are certain disadvantages attending its use that many will consider outweigh the gain in light.

Fig. 13 shows the triplex lamp with the dome or top raised, and the doors open. A is the reservoir, 6½ inches long by 4 inches wide by 1⅞ inch deep; B, the dome 6⅛ inches long by 4 inches wide by

The first thing to make is the reservoir, usually constructed of tin. First cut out a piece of tin (or other sheet metal) 10 in. by 7½ in., then cut out the corners as shown in Fig. 15, the three apertures for the wick-holders, A, B, C, and the circular opening, D, which is intended for filling the reservoir. The three apertures, A, B, C, are each 1⅝ inch by 9/16 inch; they are cut out parallel with one another, but it must be noted that the centre one, B, is not in the exact centre of the reservoir. The space between A and B is 1 inch, and that between B and C ¾ inch. The diameter of the circular opening may be ¾ inch, or more or less. Now bend down the edges of the side and end pieces where the dotted lines are, cut off all the points, and form the piece into an oblong box about 6½ inches long by 4 inches wide, and solder the corners together. Cut out a piece for the bottom rather less than 6½ inches by 4 inches, but do not solder it on until you have made and fixed the wick-holders in their place.

The wick-holders are formed of two pieces of tin each; three of these pieces are 2 11/16 inches by 1⅞ inch, and the other three are 2 11/16 inches by 2⅝ inches (see A and B, Fig. 16). The B pieces are of the same width at top as the A pieces, but at a distance of 1⅛ in. from one end they widen gradually to 2 9/16 inches.

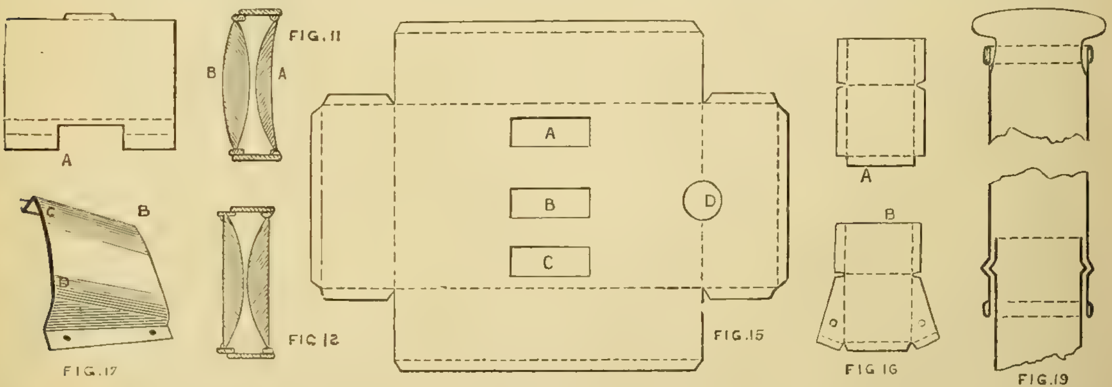


FIG. 11.—DOUBLE CONDENSER OF (A) MENISCUS LENS AND (B) BI-CONVEX LENS. FIG. 12.—ANOTHER CONDENSER OF TWO PLANO-CONVEX LENSES. FIG. 15.—PLAN OF RESERVOIR WITH APERTURES FOR WICK-HOLDERS. FIG. 16.—TWO PIECES FOR WICK-HOLDERS. FIG. 17.—PIECES OF IRON FITTED INSIDE DOME. FIG. 19.—THE CHIMNEY.

3½ inches high. One end of the dome is closed by a piece of glass let into a frame, and the other end by a reflector, C, also inserted in a frame. E E is a frame or support for the dome to rest on, and to the front of which it is hinged. The three wick-holders, and the rods for regulating the wicks, are more clearly shown in Fig. 14.

Make the cuts shown in the figure, and turn up the sides at the dotted lines to form shallow troughs 1⅝ inch wide. The A pieces should be bent into somewhat wider troughs than the others, so that they may fit over them. Now get six little cog-wheels and three pieces of stout wire to serve as rods for turning the cog-wheels. Put a bit of 1½ inch wick into the B

troughs, arrange the wires and cog-wheels over the wick, and make a mark exactly where the wires are to pass through the sides of the trough, and then make the holes shown in the figure; they should be exactly the size of the wires. This done, put the wires through the first holes; fix two cog-wheels on to each wire about $\frac{3}{4}$ inch apart, put the end of the wires through the second holes and fix a couple of little metal washers on to the wires at E and E to keep them in their place. Try how they work with the wick, and if they work well, bend the other troughs slightly where the side cuts are until they exactly fit, then solder them on, and, lastly, fit them over the apertures in the top of the reservoir and solder them down. They are turned with the rods to the back of the lamp (the end of the reservoir opposite to that with the circular opening). Three little bits of brass about $\frac{3}{4}$ inch long, rounded at one end, and with an edge turned over at the other end, will make holders for the rods, as shown in Fig. 13. They are soldered on to the top of the reservoir near the back. Finally, three small brass knobs should be soldered

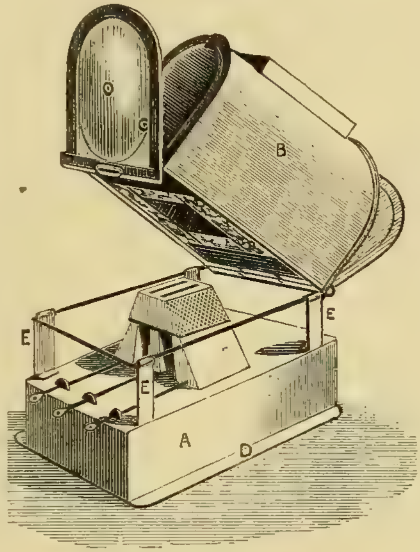


FIG. 13.—TRIPLEX LAMP WITH DOME RAISED.

holders. They may be made of two pieces of perforated tin, $1\frac{1}{2}$ inch square, bent into the shape of a U. Two other similar troughs are soldered on outside the two outer holders, as shown in the figure. They are about the same width as the holders, and about $1\frac{1}{4}$ inch deep.

The bottom piece can now be soldered on to the reservoir, and a brass ring of any convenient diameter (say 1 inch) affixed to the back of the lamp by means of a strip of brass or tin passed through it and soldered on to the bottom. This ring is for pulling the lamp out of the lantern, for which purpose the rods should never be used. Two strips of tin rather shorter than the reservoir, and about $\frac{3}{4}$ inch wide, must then be soldered to the bottom, one at each side, to form the two tongues to run in the grooves in the lantern body: they may be rounded off at the corners, and should project about $\frac{3}{8}$ inch from the bottom of the lamp.

The support or frame (E, E, E, Fig. 13) is made of a piece of stout wire (galvanized iron wire is the best) and four, six, or eight pieces of block tin or brass $2\frac{1}{2}$ inches long and about 1 inch wide. First

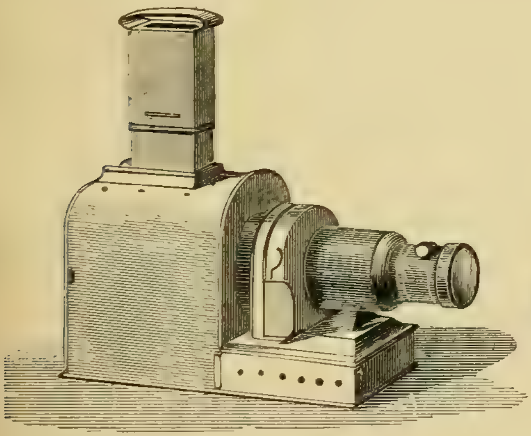


FIG. 20.—THE LANTERN WHEN FINISHED.

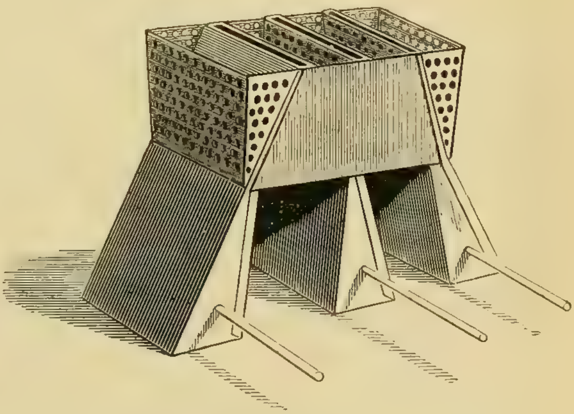


FIG. 14.—WICK-HOLDERS, AND RODS FOR REGULATING WICK.

on to the end of the rods to serve as handles. The length of the rods may be $4\frac{3}{4}$ inches, and the diameter of the little cog-wheels about $\frac{1}{4}$ inch.

The three wick-holders must be connected at the upper end by means of two little pieces of tin (about 1 inch wide) soldered on at back and in front. Two small troughs are also to be soldered between the

bend the wire into an oblong frame of the same width as the reservoir, and $5\frac{5}{8}$ inches in length, then turn down $\frac{1}{8}$ inch at one end of the strips, and about $\frac{1}{4}$ inch at the other end; put a strip at each corner of the frame (and if you have cut out six, one about the middle of each side), and hammer the $\frac{1}{4}$ inch edge over the wire to secure the strips to the frame, or

solder them down; then turn the frame over, and, if necessary, bend it and the strips into shape; put it on the reservoir, and solder the other ends of the strips down to it.

The top of the lamp is generally made of Russian iron. First, cut out a piece 10 inches by $6\frac{1}{4}$ inches, turn down an edge on the two sides about $\frac{1}{4}$ inch, and cut out the aperture for the chimney ($3\frac{1}{2}$ inches by $1\frac{1}{2}$ inch). Now fix a piece round this aperture to form a base or support for the chimney. This second piece should be about $10\frac{1}{2}$ inches long by $1\frac{1}{2}$ inch wide. Bend it into a frame the same size as the aperture (or rather a trifle smaller, since it is to fit inside it). About $\frac{1}{2}$ inch will overlap at the end, which will enable you to join it together with a couple of little rivets. Then make cuts $\frac{1}{2}$ inch long at the four corners, and turn out the edges; put it into the aperture and rivet it on to the top piece, the turned-out edges to be inside the dome when the latter is bent into shape, which can now be done. To keep the dome in shape, a wire frame similar to the one we made for the stand, E E, must be fixed on to it. This second frame must be of the same width as the other, but $\frac{5}{8}$ inch longer. When you have formed the frame, you must join the ends, which you can do by filing the ends smooth, putting a little borax, made into a paste with water, on to them, and winding some brass wire round them. If you now put some more wet borax over the brass wire, and heat the frame over a clear fire, the brass will soon melt, and running into the joint, will unite the ends very securely. The frame has now to be turned down at the four corners in such a manner that the two ends may fit over the front and back of the lower frame, E E. The best way to bend the wire is by using two pairs of tweezers, with one of which you hold the wire close to where the bend is to be, and with the other you make the bend. About $\frac{1}{4}$ inch should be turned down. The frame is now ready to be fixed on to the lower edge of the top piece; and this is done by turning up about $\frac{1}{4}$ inch of the edge, and hammering it down over the wire. The next thing to do is to cut out two little pieces of Russian iron $3\frac{11}{16}$ inches by $2\frac{3}{4}$ inches (A, Fig. 17), to be fitted inside the dome, and two pieces $3\frac{1}{2}$ inches long by $1\frac{3}{8}$ inch wide; which last, when bent into the shape shown at B, Fig. 17, are riveted on to the first two pieces, and form a sort of burner (see Fig. 18). The width of the opening between these two side-pieces is $\frac{15}{16}$ inch, and it is 2 inches long from A to B. The two side pieces are joined to the end-pieces with rivets, and the whole forms a kind of bridge. The opening is about $1\frac{1}{4}$ inch from the bottom of the dome, and the top of the little side-pieces is $\frac{1}{2}$ inch above the top of the wick-holders. A piece of fine perforated tin $3\frac{11}{16}$ inches square, with an aperture $2\frac{1}{8}$ inches by $1\frac{3}{8}$ inch in the middle, is riveted on to the other end-pieces, as shown in Fig. 13.

The frames for the front and back of the dome are made of thin sheet copper, as copper is the most malleable metal we can use. The two frames are similar in size and construction, so that only one need be described; but the strips required for both can be cut out at once. Two strips of copper are all we want (for each frame); one $4\frac{1}{16}$ inches by $\frac{3}{8}$ inch, to form the lower groove, and the other 10 inches by $\frac{3}{8}$ inch to form the two sides and the rounded top. The first or bottom piece being straight, is easily made into a groove about $\frac{1}{4}$ inch deep and $\frac{1}{8}$ inch wide; the other piece is much more difficult to form. It must be hammered over a metal or hard wood disc of the shape of the top of the lamp. With a suitable disc and some care and patience a neat groove can be formed without a "wrinkle" or inequality anywhere. The two ends of the upper groove rest in the lower one, which must be slightly widened at the corners to let them in. A rivet is used to join them at one corner; but as it is often necessary to open the frames, it would be inconvenient to rivet them at both corners. A little bit of copper wire put into a rivet hole, and the ends turned down, will answer all the purpose.

The lower groove is hinged on to the end of the wire frame, and a catch formed of a strip of metal about $\frac{1}{2}$ inch wide and 2 inches long, bent back on itself to act as a spring, and riveted on to the top of the dome keeps the frame shut. The hinge is made of a strip of brass about $1\frac{1}{2}$ inch long, and 1 inch wide. One side is bent into the shape of a U for the bottom of the frame to rest in, the other side is hammered over a piece of wire, or a "French" nail, of the same thickness as the wire of which the frames have been made: thus a little tube is formed at one end of the U. This tube is sprung over the wire of the dome-frame, and secured with solder, the frame being put into the U and soldered to it, the hinge is complete. The two ends of the bridge-pieces, Fig. 18, are turned over the wire frame on either side of the hinge, to finish off this part of the lamp.

The reflector is made of copper, and plated. It is hammered into shape from a piece of sheet metal about 4 inches square. The concavity given to it is not of very much importance, practically speaking, but it is very necessary to avoid all inequalities, such as ridges or dents in its surface. A hole about $\frac{1}{2}$ inch in diameter may be made in the exact centre of the reflector to enable the operator to look into the lamp from time to time when in use, for the purpose of regulating the wicks. This hole being directly behind the wicks, or rather the flames, will not in any way

interfere with the working of the reflector. About a $\frac{1}{4}$ inch of the edge of the reflector is left flat, and a small piece is cut off the bottom and sides to let it fit into the grooves. Of course, only the front (concave side) of the reflector requires to be plated. As a rough and ready means of determining the concavity I may mention that the centre should be sunk about $\frac{7}{16}$ inch below the sides.

Cut out a piece of glass to form a window for the front frame, and a piece of talc to put in front of the reflector in the back frame; then get a short length of brass tubing, fitted with a screw-cap, and solder it in the hole in front of the reservoir; and, lastly, hinge the dome on to the support in front. The hinge is made of a piece of brass or copper, $3\frac{1}{2}$ inches by 1 inch, one side is turned over a wire to form a tube, which is then sprung over the wire of the support and soldered; the other side is riveted to the lower part of the bridge.

We have now only to make the chimney, which is easily done. You can use sheet iron, tin, brass, or copper for it, and you must cut out three pieces, two for the chimney itself, and one for the top, as it is made on the telescopic principle for convenience in packing, and one of the tubes must be somewhat smaller than the other to slide within it. The lower tube fits on to the top of the dome, and slides within the upper one. They are both 5 inches long, and the upper one is $3\frac{5}{8}$ inches by $1\frac{5}{8}$ inch in width. You should cut out a piece $11\frac{1}{4}$ inches by $5\frac{1}{4}$ inches for it, which will allow inch edge to be turned down at top and bottom, and leave about $\frac{1}{2}$ inch to overlap at the side. The other piece may be about $\frac{3}{8}$ inch shorter. An edge should be turned over at the lower end of the smaller tube, and at the upper end you must make two $\frac{1}{2}$ inch cuts at each side about $1\frac{3}{4}$ inch apart, and bend out the piece between the cuts so as to form a sort of catch on each side of the tube. At about half-an-inch from the lower end of the upper tube you make a groove or indentation about 2 inches long on either side of the tube for the two catches which thus keep the upper tube in its place, as shown in Fig. 19 The top is a piece of the same metal, $7\frac{1}{4}$ inches ong by $2\frac{3}{4}$ inches wide in the middle, tapering to $1\frac{1}{2}$ inch at the two ends. It is fixed on to the upper tube with two rivets at each end. Our lamp is now ready for use. Fig. 20 shows the finished lantern.

Thus far, then, have we proceeded together in its construction, and the result is an instrument, which, if tolerably inexpensive to make would be dear to buy. If the parts have been properly put together it will be suitable for every purpose for which a lantern of this kind may be required.

(*To be continued.*)

THE REFLECTING TELESCOPE:

ITS CONSTRUCTION AND MANUFACTURE.

By EDWARD A. FRANCIS.

XIV.—ADJUSTING THE MIRRORS—THE FINDER—THE TELESCOPE IN USE—DEFECTS AND THEIR REMEDIES.

LET us take the roughly-mounted telescope, which the completion of Chapter XIII. left in the possession of our readers, away into the open air. Not at night-time first, for the adjustments have yet to be completed, but in the daylight. We may hope that the moon will be well up, and in a good position, later in the evening; for after twelve months' work the result of our labour is to be tested. Success or failure —which will it be?

And first, as to the support of the mounting-board. Well, anything will do. Years have elapsed since the writer worked with such a mounting himself—it is lying by somewhere or other now, a reminiscence of past struggles; but he can well remember the ease and comparative comfort with which he manipulated it, as it rested upon the back of an ordinary Windsor chair: that, too, when using the mirror it contained to photograph the progress of a lunar eclipse. Anything, then, from the garden fence to a common tressel or a huge ball and socket joint, will serve to elevate the eye-piece end of the instrument from the ground; but the amateur who cannot devise some means to support it steadily while it is directed towards any object, had better not read these papers.

We mentioned just now certain necessary adjustments: let us think for a moment about them. The greater speculum, it will be remembered, acts in the same manner as a great burning-glass: it concentrates the light and heat incident on it to one point. That point is the focal point, and will be in our case, about 5 feet distant from the great mirror. Now, the simplicity of the adjustments may be noticed. It will be evident that a slight inclination of the mirror surface in any direction would cause the position of focal image to move also, so that by adjusting the chief speculum in its cell, the patch of light reflected from it may be thrown upon any given place. Very good. Let us remember this while we attend to the small mirror.

The eye-piece tube (H, Fig. 79, Vol. V., p. 553) being centrally placed and firmly secured, the small mirror should be so adjusted that it will appear as a circle concentric with the eye-piece tube when viewed through the latter without an eye-piece; that is to say, that the edge of the eye-tube farthest from the eye will present a circular field (A, Fig. 94), in which the

circle of the flat (B, Fig. 94) will appear to be centrally placed.

The state of adjustment having been obtained, the flat should then (being placed at right angles with the axis of the instrument) reflect through the eye-tube a picture of the larger mirror (C, Fig. 94). This introduces a third circle, and if the eye-tube and flat are both properly placed, this third circle should be concentric with the other two. Thus the circles appear. Outside of all (A, Fig. 94), the inside edge of the eye-tube, next (B, Fig. 94) the ellipse of the flat projected as a circle, and innermost (C, Fig. 94) the great speculum. If the latter circle be not concentric with the others, the adjustment of the flat, and possibly that of the eye-tube also, may be required to be altered. It may be observed that a little experiment with the different movements of which the flat is capable will soon cause the amateur to understand which of those movements may at any time be required to secure concentricity of the three circles concerned.

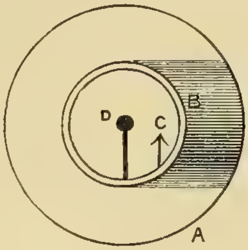


FIG. 94. — APPEARANCE OF EYE-TUBE WHEN MIRRORS ARE PERFECTLY ADJUSTED.

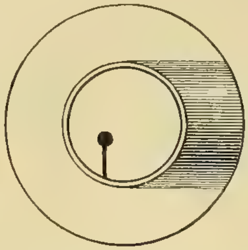


FIG. 95. — APPEARANCE OF EYE-TUBE WHEN GREAT MIRROR REQUIRES ADJUSTMENT.

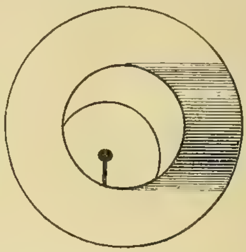


FIG. 96.—APPEARANCE OF EYE-TUBE WHEN FLAT AND EYE-TUBE NEED ADJUSTMENT.

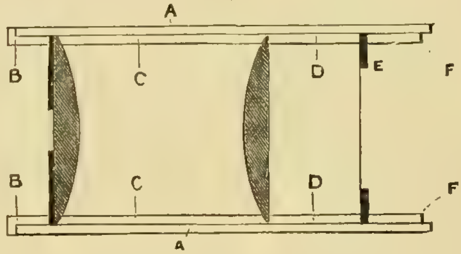


FIG. 98.—EYE-PIECE FOR FINDER.

We will now imagine for a moment that the telescope is directed towards the moon. Somewhere near to the flat there will be a space in which, if a piece of card be held, an image of the moon would be projected on to it by the great mirror. When the instrument is completely adjusted, that space will be occupied by the flat. The great mirror then has to be slightly inclined, one way or the other, by means of the little screws at its back, until the focal image of anything towards which the telescope is directed is thrown exactly upon the small mirror, and so reflected out through the eye-tube. This state is obtained when the flat (D, Fig. 94) is seen reflected in the mirror (C, Fig. 94) as a small round spot. With the eye at the eye-tube, it may be noticed which part of the mounting is seen reflected in the circle C; and this will serve to guide the amateur as to the direction in which the great mirror is to be moved, and, consequently, which of the adjusting screws requires to be turned.

The Figs. 94, 95, 96 represent respectively (Fig. 94) the appearance through the eye-tube when the mirrors are in perfect adjustment; (Fig. 95) when the great mirror requires to be adjusted, the reflection of the flat not being centrally placed; and (Fig. 96) when the flat, and possibly also the eye-tube, will require to be adjusted, in order to centralize the reflection of the larger speculum.

It will be seen that when these adjustments are once completed, the eye-piece may remain fixed: it will not require to be moved again. In a roughly-mounted instrument, however, the other adjustments—those of the flat and great speculum—may require to be attended to each time that it is intended to use the instrument. A completely mounted instrument having been once adjusted may not require readjustment for many months. Daylight being unattainable, the telescope should be directed to an illuminated white surface a few feet distant from the mouth of the instrument. A small contrivance, made as follows, is useful to secure exact adjustment: Procure a piece of tubing of the same diameter as that used for the eye-pieces, and about 3 inches in length, and also two pieces $\frac{1}{4}$ inch and $\frac{1}{2}$ inch respectively in depth, that will fit tightly inside it. Into one end insert the $\frac{1}{4}$ inch length to form a ledge upon which (from the other end) a perforated metal disc, similar

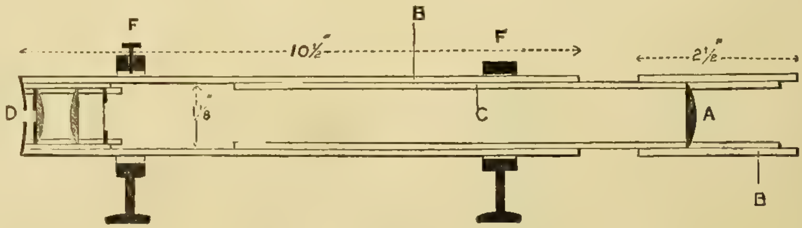


FIG. 97.—SECTION OF THE FINDER.

to E, Fig. 91, but with scarcely more than a pin-hole aperture, may be dropped, being secured in place by the ½ inch length of tubing. If this contrivance be placed in the eye-tube, and the mirrors viewed through the pin-hole, the adjustment may be very correctly performed. The perforated disc must necessarily be of the same dimension as the internal diameter of the long (3 inch) tubing first mentioned.

The telescope may now be directed to the moon—not at full, for then a somewhat experienced eye would be required to detect any fault in definition. The pointing may be done by resting the side of the head upon the base-board, and pointing the tube of the flat mounting as truly as possible; but a more precise method is required. This is obtained by mounting a small finder upon the eye-piece box, as shown at K, Fig. 79. The construction of the finder shall be treated of in the literally simple manner resorted to when we were considering the making of the eye-pieces. The materials requisite are :—

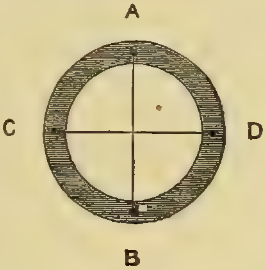


FIG. 99. — CROSS WIRES ON RING FOR FINDER.

A, a common achromatic lens of about $1\frac{1}{8}$ inch in diameter and 13 inches in focal length—*cost not more than 3s., most probably less*; B, 13 inches of mandrel-drawn brass tubing, of such a diameter that the lens, which should be first procured, will nicely fit inside; C, 8 inches of similar tubing of such a diameter that it will slide tightly within tubing, B; D, a Ramsden eye-piece of very low power, formed, for instance, of two plano-convex lenses, each of 1 inch in focal length. (See Chapter XIII.)

Divide tubing, B, into two lengths of 10½ inches and 2½ inches respectively. If possible, a lathe should be used, but it is not necessary. The greater length of tubing, that of 10½ inches, is the foundation tube of the finder. (See Fig. 97.)

The tubing, C, should also be divided into two lengths, of 7 inches and 1 in. respectively. It is imperative in this matter, as previously in that of the eye-pieces, that the edges of the tubing should be flat and true, so that if the length of tube were placed on edge on a levelled surface it would be perfectly vertical with that surface. This, so that the lens which rests upon a ledge formed of the edge of the inner tubing, may be accurately placed.

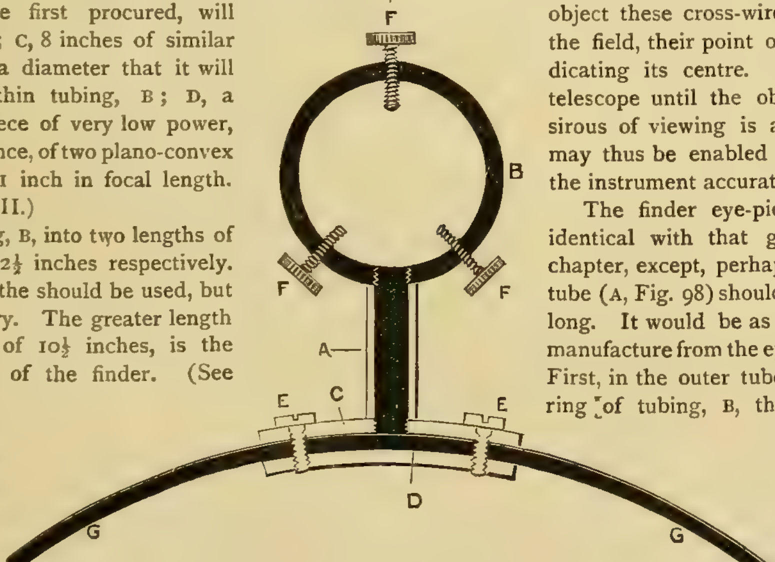


FIG. 100.—FINDER SUPPORT WITH ADJUSTING SCREWS.

Take the 7 inch length of tubing, C, and the 2½ inch length of tubing, B. Insert one end of the former 1 inch within the latter (see Fig. 97), and secure it by soldering or with three small screws. Upon the ledge so formed place the little achromatic lens, flattest side downwards. The 1 inch length of tubing, C, serving to hold the lens in position. If now an eye-piece be fitted into one end of the foundation tube and the object lens, and its mounting, just completed, into the other, it will be found that a small astronomical telescope has been constructed—the finder. Distinct vision is obtained by sliding tube C within tube B, and not, as in the ordinary form, by sliding the eye-piece to and fro.

But we must now describe an important little addition to the eye-piece, upon which the value of small telescope, as a finder, depends. The eye-piece, as just stated, should be of the Ramsden construction, and, therefore, the focal image formed by the achromatic lens when properly defined, would be outside the eye-piece. What we have to do is to cross two hairs, or silk strands, or exquisitely fine wires, and fix them as diameters of the field of view, at such a distance from the eye-piece that whenever we view an object these cross-wires will appear in the field, their point of intersection indicating its centre. By moving the telescope until the object we are desirous of viewing is at that point, we may thus be enabled at once to direct the instrument accurately.

The finder eye-piece, otherwise, is identical with that given in the last chapter, except, perhaps, that the outer tube (A, Fig. 98) should be fully 2 inches long. It would be as well to begin its manufacture from the eye-end as follows: First, in the outer tube, A, fix the small ring of tubing, B, then a perforated disc for the eye-hole; next, plane side downwards, the eye-lens. To keep the latter in position, and at the proper distance from the field lens, the tubing, C, being just a shade less than 1 inch in length and bevelled at its inner edges, may next be placed in position. Then the field lens, convex side downwards, and finally tubing, D, about one-half of an inch in length, should be fitted close up to the field lens.

A perforated disc of thin brass, of the same dia-

meter exactly as the field lens should now be obtained. It must be similar to Fig. 99; the width of the flat ring of metal being about one-eighth of an inch. Two tiny holes, each just large enough to permit a hair or very finely-drawn wire to pass through, should be drilled at A and B, and two others at C and D. The holes must be so placed that the stretched wires will be at right angles to each other, and will meet exactly in the centre of the disc, dividing the space into four equal divisions of 90° each. The wires should be secured in the holes with little plugs of wood.

This ring is to be placed in position at E, Fig. 98, having the strained wires next to the field lens, and the whole eye-piece completed and rendered secure by the fixture of the tubing, F.

If it has been properly constructed, upon being held up towards the light the brass ring, E, will be seen through the lenses, limiting the field of view, and the cross-wires will be plainly defined, so that any dust or irregularity on them will be exactly visible. If this be not so—if, on the contrary, the wires and ring border are ill-defined—then the tubing, D, must be taken out and slightly cut or ground away, so that the ring, E, may be moved nearer towards the field lens. A little experimenting will very soon set all right. The eye-piece should then be fitted into its proper position (D, Fig. 97). Evidently the easiest manner of so doing is to first fit it into a short length of tubing (B, Fig. 97), and slide this into A; unless, as is probable, the size of the lenses permits of the outer tube (A, Fig. 98) being directly formed of tubing of the same kind as B, Fig. 97.

This finder, polished and lacquered, if the amateur can so do, is finished. We have now to form the apparatus for connecting it to the main instrument.

First, for the benefit of those who, shrinking from the labour of manufacturing a great reflecting telescope, would yet like to possess an instrument that would show to them "sun-spots, the lunar mountains, the moons and belts of Jupiter, the rings of Saturn, and the double stars and nebulæ" (we quote now from the prospectus of a popular five-guinea telescope), we will mention a few facts.

A good achromatic object lens for a refracting telescope, 2 inches in diameter and about 24 inches focus, will furnish sufficient light to show all these things. It should cost at the utmost 15s., and may possibly be obtained for less. The writer once obtained an excellent 2½ inch lens for half-a-guinea; but possibly that was a chance bargain—it might have been a bad one; but if a 2 inch lens be purchased at the price named from some responsible optician, the method of mounting just described for the finder may be followed out, only that the body tube of brass should be in one piece, the eye-piece being carried at the eye-end of the telescope by a draw-tube like unto Fig. 82 or Fig. 83. The eye-piece should be made as in Chap. XIII., but the component lenses might be of a lesser focal length than those there given. Thus, at a cost of less than 30s. an instrument that would be no mere plaything would be obtained—one with which valuable work might be done, and which would, at any rate, demand many a night of star-gazing before its capacities would be exhausted. An ordinary knuckle joint would be required for mounting the tube upon a post or stand; but no more need be here said, save that in this, as in all other matters pertaining to the making of the telescope, the advice and experience of the writer are at the service of any reader who may wish to use them.

We return to the method of mounting the finder. Many an astronomer has worked with a finder bound to his instrument by wire and adjusted each night before use: we shall describe the proper form of connection.

The finder is supported by two rings, F and F, fitting it as shown in section in Fig. 97. The first of these is further illustrated in Fig. 100; the second is like to the first, but has not any adjusting screws: it simply fits the finder tube exactly at one edge, and is slightly bevelled away towards the other.

In Fig. 100 we have assumed that the finder is to be fastened to a telescope tube of sheet metal, and we have indicated the method of attaching it. This is done to save repetition hereafter. In our present case, as we shall only require it temporarily, it will be advisable to make it as shown, but dispensing with D and substituting common wood screws for those shown at E, E. The shaft, A, is an iron screw about a quarter of an inch in diameter and two inches in length. It passes, as shown, through a piece of brass tubing ⅝ of an inch outside diameter. The screw, A, is threaded into B and C. The ring B, formed of a section of stout tubing, about half inch greater in diameter than the finder, is pierced in three places and drilled to receive the adjusting screws, F, F, F; one of these latter to be at the top and the other two equidistant from each other and from the uppermost screw. The plate, D, shown inside the telescope tube, G, is of the same size as C, and is drilled and tapped to receive the screws, E, E, which pass through C. The second support is similarly constructed, except that the internal diameter of its ring should be only just such as to receive the finder tube—without side shake—and should be slightly bevelled inside from one edge to the other.

To adjust the finder, set the screws, F, F, F, cen-

trally, point the main instrument with the unaided eye to some distant object, or the moon. Then place the finder in position, packing it up, if necessary, beneath either support until the lunar disc is seen intersected by the cross wires, when the supports may be screwed to the eye-piece box. Any subsequent adjustment, and this in a temporary mounting such as that we are discussing, requires to be attended to every time the mirrors are adjusted, may be made by the means of the screws, F, F, F.

In this finder, the amateur has every opportunity to construct a pretty well finished little instrument, and that without any other than the simplest tool. It is to be hoped that he will succeed in so doing.

The completed telescope may now be taken out into the open, and if the moon be well up—we will assume that it is so—it shall be the first object to which our instrument shall be directed. To place the telescope in position, the finder may be used. Move the base-board of the rough mounting upon whatever is being used to support it, until the moon's disc is seen in the finder, centrally placed—that is, divided into four equal parts by the cross-wires. Then armed with an ordinary eye-piece proceed to the eye-tube—the moon should be found in the field of view; if not, the finder is not properly set. The lunar disc will appear through the eye-piece as a great hemisphere more than filling the field of view, and more or less perfectly defined. One edge of it—the straight-edge at first quarter, for example—should be found, and the shadows and irregularities carefully scanned. If all be indistinct, and nothing can be seen save a glare of light, move the focussing tube slowly inwards or outwards. A position will soon be found when any black marks (the shadows thrown by high ground) on the moon's surface will appear more black and more finely defined than with the eye-piece in any other position. If the mirrors even approach to accuracy the sight should be a splendid one, and that more especially if the amateur has taken a little trouble to discover—in astronomical works—what he should see, and why the appearances he discerns are as they are.

Most probably, as was just said, the lunar definition, even if the mirrors be not quite perfect, will be very good; in which case the next object upon which we will test the instrument should be one of the planets—Jupiter or Saturn—preferably the latter. Any error of construction will now be very apparent. Prismatic colouring around the focal image, general indistinctness of definition—flares or wings of false light round the planet—or the image may be totally misshapen. Let us at once proceed to discover the cause of these errors.

The appearance of prismatic colouring *must* be the result of an error in the construction of the eye-piece, for the action of mirrors, however badly they may be figured, will not cause colour; reflected light is not broken up as is refracted light. Therefore, this defect may be remedied by looking to the making of the eye-piece, or if more than one eye-piece was made, by using the second.

The false light and flares, if any be apparent, will be the result of want of adjustment in the telescope. Remove the eye-piece and examine adjustment. In exceptional cases the great mirror has been known to perform best when slightly out of adjustment; experiment with the adjusting screws; and, lastly, rotate the flat a very little, or otherwise move it, while watching the effect of such movement at the eye-piece. A totally misshapen image will be the result of extreme want of adjustment. Do not judge your instrument too quickly; leave it in the air for an hour or so (protecting the speculum), so that it may get of the same temperature as the air itself; or, at least, try it again on a future night, before seriously interfering with the mirrors.

We have disposed of the defects which are capable of being cured without repolishing the mirrors. Next month we shall treat the defects which require for their remedy that the mirrors should be retouched.

(*To be continued.*)

PATTERN MAKING FOR AMATEURS.

By A. J. SCOTT.

III.—CORE PRINTS.

HAVING in my two previous articles described the tools necessary for pattern making, and also how to plane a length of timber up pretty true, I will now endeavour to initiate the amateur or novice into some of the mysteries of this branch of wood-working, which, I might go so far as to say, is generally unknown outside of the foundry or pattern shop. I shall presume the amateur knows how to use his tools, and to keep them in order; also, that he is not incapable of drawing a little, which latter, if he be proficient, will very greatly assist him. In commencing any kind of work it is always best to make a full-size drawing if it is anyways possible; by doing so you will get the correct angles and sizes of whatever timber you require to get out; also any mistakes or little points not easily seen in the small drawing to scale now being magnified full size, is very much more easily detected. In putting patterns together it must be borne in mind that patterns of castings are not furniture; therefore it is not required of you to hide all screws, nails, etc., as the holes being filled with putty

will draw out of the sand as easily as one continuous surface of timber.

Perhaps the first thing that will bother our amateur pattern maker is the required holes in the castings, and also the hollowness, so as to speak, of box castings. This is done by what moulders call, in technical language, "Cores," the same cores supported in the mould by extending lumps of wood on the pattern termed "Core Prints." These core prints I shall take upon myself first to explain, as there is seldom a casting without having some holes formed by cores which would have their places noted on the pattern by the core prints already spoken of. These same core prints make one of those little matters sometimes not much thought about at the time, but which at the same time lies at the very root of the pattern maker's craft. Sometimes it is even unnecessary to fasten a core print on a pattern as it can be sustained in its place by means of chaplets, or chaplet blocks, both of which terms now it is my duty to explain to the amateur's own satisfaction. Chaplets, or chaplet blocks, are of various designs, and are used as supports for the cores in castings to keep them immovable during the pouring of the metal in the mould, as if they were not securely fastened by chaplets, and sometimes bolted, they would be washed out of their place by the rush of the metal when the mould was filled.

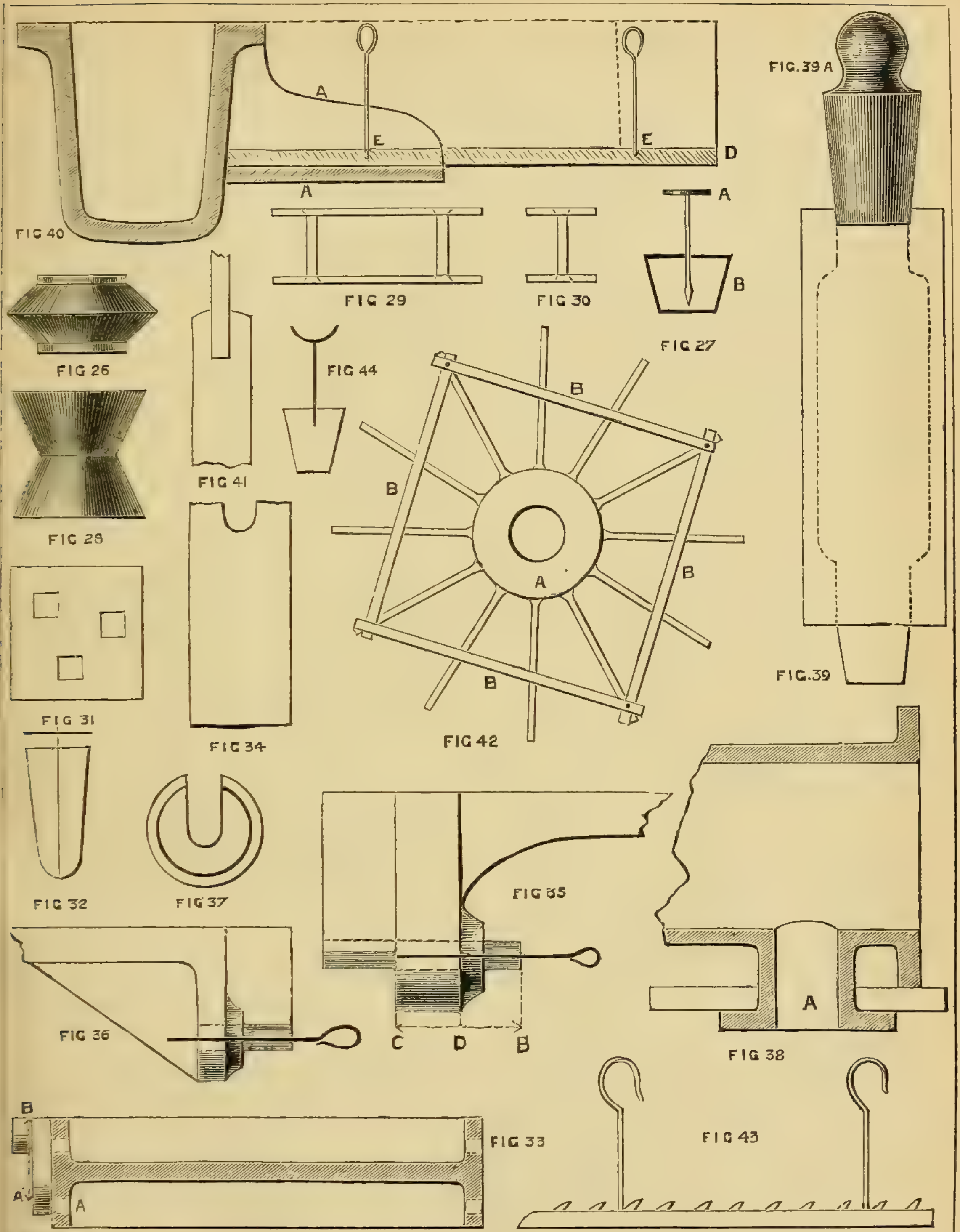
I will speak of this matter later on, and will now suppose as a summary that the amateur knows that a core is either to lighten the casting or leave a hole in of precisely the same shape and size. We will now pass on to another preliminary subject; that is, a mould covered by sand all over must be in two parts *at least*, so from that we may gather there must also be at least one joint. This same joint is not always necessary to be at the top or middle of the pattern, neither is it a hard and fast law to be always in a straight plane or in a horizontal or perpendicular direction; these are points which differ with the work required to be moulded. The bottom half of the mould, which is very often dug out of the foundry floor, is termed the "bottom part." Above the joint, the "top part," these two technical terms I wish to be impressed on the amateur pattern maker's memory, as they will be used very much by me in the course of these articles. They will also serve to indicate the different parts of the mould I am speaking about; therefore, summing up all we have learnt we get the following: We must first of all if we wish to lighten our casting, or to cast any holes required in, generally do this by fastening core prints on the pattern; secondly, *most* moulds contain two parts jointed together, technically termed "*top and bottom parts*."

So far so good; we must not get on too fast. Suppose we put practically the knowledge we have now acquired, and for an example in the simplest form we will take a plate of metal 6 inches square with three round or square holes in the plate, as in Fig. 31. What must we do? We must first of all plane a piece of wood the required dimensions of the plate, allowing for contraction, which in this case would be very slight, hardly one-sixteenth part of an inch, and in very small castings you will sometimes find your casting larger than the pattern, which is on account of the moulder rapping the pattern about in the sand, which, I might also say, is very unnecessary to that extent.

Having now planed the plate up, set the holes out, and in this case we will suppose the plate to be about three-quarters of an inch in thickness, we pare three pieces of wood the required size of the holes, and fasten them on; let them be about one-half of an inch in thickness, and you will get now three holes in the casting when you receive it in precisely the same position. All other prints are but a modification of these same round or square prints I have described, which will now form the basis from which I shall now work from. There is another kind of print termed a "draw print," in shape like Fig. 32, whose purpose it is to enable the pattern to leave the sand, yet leave a recess for the moulder to drop his core in, as at A, Fig. 33; A representing size of hole wanted, B the distance from hole to centre of mould joint. All other prints, however much different they may be in appearance, belong to this or the preceding type.

To return again to the ordinary round or square core prints, their depth or thickness of print must be regulated by their size, as a large print would not require to be so thick as a small print, for it would steady itself in the mould so much better than a smaller one; also, as regards their "strip" or taper ("strip" is another technical term employed in pattern making) the amount will vary, according to the diameter and length—a large diameter of print, as I have just said, not needing to be so thick, will not require so much strip as a smaller one, especially one which has a very long core. Now, in regard to the size required; this it must be at the bottom edge of the print, nearest the pattern, as the moulder will then just rub his core a little to suit the taper or strip. Put in it, if the print was left the actual size, at the top it would be rather loose in its place, and the recess so left around the core would require to be filled up by the moulder, thereby taking longer time and not being so good a job and true.

Now, as to draw prints, leave these of such a thickness as would be sure to keep the core balanced in its place without fear of the other end dropping out of its proper place, thereby leaving the hole required, which ought to be square, on an angle. To explain more simply, I will suppose (in Fig. 33) a casting of a



FIGS. 26, 27, 28, 29, 30.—EXAMPLES OF CHAPLET BLOCKS. FIGS. 31, 32, 33.—EXAMPLES OF DRAW PRINTS. FIGS. 34, 35, 36, 37.—MAKING-UP PIECES. FIG. 38.—EXAMPLE OF LOAM TABLE COVERING. FIG. 39.—STEADY PIN. FIG. 40.—EXAMPLE OF DRAW BACK. FIGS. 41, 42.—SAW ARM WITH WROUGHT BLADES. FIG. 43.—MORE COMPLETE VIEW OF PLATE IN FIG. 40.

short stay beam, which requires two holes in each end in the same vertical plane, the thickness of ends, for supposition we will say $\frac{7}{8}$ inch: the best plan would be, firstly, to fasten a print on, as at A, Fig. 33, $\frac{1}{8}$ inch or $\frac{1}{4}$ inch thick, which would be $\frac{1}{4}$ inch or $\frac{3}{8}$ inch thicker than the ends, and would keep the core when it was placed in the recess formed in a horizontal plane as required. The moulder having dropped his core in position, would require what is called a "making up piece," as at Fig. 34, which is a thin piece of wood with a semicircular hole of the size of the print, cut out at the end, he will drop this over his core, and ram up with sand solid the recess left by the draw print, the other hole in the casting he would do the same. Sometimes the metal being thick it is better to fasten two draw prints on the pattern, which give, as you will naturally think, a great deal better bearing. In some cases it is better to leave an ordinary round print at one side, and a good broad draw print on the other, as is the case with Fig. 35. In this you will perceive a washer on one side, which being bedded in a vertical direction in the sand would not draw out, so we fasten an ordinary round print on the washer, and then send a skewer through both, thereby enabling the moulder to draw the washer and print loose, but taking care that the thickness from D to B is a little under the thickness of C and D, to enable it to be drawn from the mould. The moulder, in putting the core into its place, will drop it down the draw print, then push it forward into the round hole left by the washer print, he will then fill up the recess left by the draw print in the same way I have described for the others. Another variety which may come in constant use with the amateur is shown at Fig. 36, which represents a hole cutting through a washer or boss, a draw-print only being used as a guide for the core in the mould. In this case you would require again the washer fastened by skewers as shown, and an extra washer making, as at Fig. 37, to make up the complete circle in the mould; this, like the other making-up pieces, will require a semi-circular hole same size as print.

In the case of a very long core, which requires to be set very straight, and is cast vertically, you will require what is technically termed a "steady pin," we will take for example, a casting of the form of Fig. 39, which requires to be cast on end on account of better metal; you will notice at the top end of the pattern a recess turned same size as cone required, into this recess a steady pin will fit, allowing plenty of "strip," $\frac{1}{2}$ inch diameter not being too much in this case. The moulder will then, after putting his "top part" over his mould, drop this core into its place, lastly filling up the recess left by the strip of the steady pin.

This method of putting cores into moulds can also be pursued at the sides of the pattern when it is cast into boxes, and openings in the box at the proper place, but it is not generally adopted, except in particular cases, which I hardly think will come under the amateur's supervision.

These "steady pins" are surmounted by a handle, as at A, Fig. 39, this is to enable the moulder more easily to draw it out of the sand. There is also another method of taking out recessed portions of castings, which is known by the name of a "drawback," the word literally tells it's own practical meaning. In Fig. 40 I will illustrate this more clearly; and for supposition, I will say a bracket requires to be cast on the engine bed, shown at A, Fig. 40, the complete figure showing section of a girder-bed for a horizontal engine.

How would the amateur, who has up to the present followed my instructions, do this? I suppose he would put a core above the bracket, the dotted lines showing the core print, but it would not be a quick way of making it; the best plan would be to screw all from the outside of pattern, leaving the screws plainly visible so that the moulder can easily distinguish them, and, if necessary, draw them out. After the moulder ramming the sand of the mould level with the line, as at D, he would make a plate to carry his sand for the drawback, as at E, a more complete view of plate shown at Fig. 43. After laying the plate in the position shown, he would ram up as usual, but leaving a recess behind a little above the width of projecting pieces, so as to enable the moulder to lift it out of its place before drawing the pattern. Having drawn this out of place, you will notice now how the pattern can be easily drawn, as no other protuberance is in the road. These drawbacks are very handy in a variety of work; another method which is very much employed for something after the same style of work, is covering the overhanging piece by a loam cake.

I have got to a part now which I believe needs some more explanation than a loam cake, and at the same time will look into one or two little matters that I perhaps ought to have explained a little earlier. Pardon me for the transgression. A loam cake is made out of almost the same substance as a core, what is termed "dry sand." I will explain: in moulding there is what is termed "green sand," "dry sand," and loam moulding. Green sand moulding is the one which is used almost exclusively, a section of work in each shop only coming under the other two heads. Green sand is the ordinary foundry sand known technically under that name, and under this section all varieties of work are moulded, but most generally with a pattern. Some moulds are struck up with boards in loam in a plastic condition,

hence the term of loam work in moulding. Dry sand is loam not in a plastic condition, and moulded as in green sand, but afterwards put in the stove and dried, these moulds are equal to loam moulds. These are practically dry sand moulds having to be dried in the stove before fit for use, and the loam set hard enough to withstand the rush of the metal.

You will now have a better idea of what I mean by a loam cake, it being merely as its name suggests, a cake of loam of various thicknesses, generally about one and a quarter inch. To indicate how these cakes are used, I will refer the amateur to Fig. 38, which represents section of steam branch, with inlet branch cast on side, as shown. You will notice the pattern could not be drawn as shown, the flange of branch being in the way; to overcome this is made a cake of loam as described, with a round hole cut out of the centre, same size as body of branch shown at A, Fig. 38.

In moulding the branch, the flange being loose, is drawn out, and in its place the loam cake is dropped, as shown; the pattern is then moulded in the usual way, with the flange detached, as then there will be nothing in the way now to stop the pattern from being drawn. We have sometimes to cast wrought iron into cast, or fasten wrought into cast, in pouring the metal in mould; for example, in the fan arms represented in Fig. 42, having a cast iron boss, A. In making this you will require a complete pattern, making, as shown at Fig. 42, the arms the same length and thickness as the wrought iron blades you intend to put in; the blades you can let in as shown in the enlarged view, Fig. 41, making a tight fit, and gluing up after fastening all the arms in place, and cutting off to correct length; fasten strips across as shown at B to keep the arms in correct position during moulding. The moulder will not mould the strip if you inform him what the reason is for which you have put it there. Perhaps some of my readers will be a little dissatisfied with discussing so much moulding, and ask why I am so particular in matters regarding it, instead of explaining how such and such a kind of pattern making is done; all in good time. "Rome was not built in a day;" and an amateur pattern maker must know a little about moulding before he attempts his first essay at pattern making. If I were to describe one *it would be no help to making the next*, and here workshop practice will differ—one pattern being made and moulded in many different ways. I know of no trade which requires more originality of thought than the pattern maker's craft, for this reason, he very seldom, if ever, has two jobs to make alike in size, etc., he has, therefore, with each one to devote some amount of thinking; for instance, the best way of moulding has to be considered, next the best and cheapest way of making pattern; so really he has an insight into two branches, namely, the woodcraft and moulding, and very often to check the draughtsman's work over, and fill in all details on the pattern left out on the drawing or tracing supplied to him.

You cannot set down in pattern-making any hard and fast rules to follow; therefore you cannot follow in that or any particular groove, like many other trades, but must devote, as I say, originality of thought, and also, if I might go so far, modification of construction. We will go, for instance, in supposition, into some pattern-shop and give to each man the same drawing or tracing, and tell him to make the pattern. I may safely say that no two men will make two patterns exactly alike, yet all shall make the same casting! How can that be? I will explain: Some pattern makers prefer making a mould almost entirely of cores, others prefer green sand, there being such a variety of opinions you will easily perceive how the patterns being made different ways are explained. In most workshops, however, the foreman in giving out the job generally will discuss the best way of making it. In this case it is much better for the men, as so doing takes the responsibility from their shoulders and leaves it on their foreman. An amateur, however, need not be deterred from making his own patterns with the difficulties I have set forth, as with a little patience and perseverance he will overcome all of them; however, I will tell him how to get a practical lesson. When he takes his patterns to the foundry to be cast, he might ask the foreman moulder whether he has made them the best way to be moulded or not. The foreman, I have no doubt, will kindly show him his faults in moulding, and no doubt explain any little point that may trouble him to fathom.

I must now redeem my promise at the beginning of this article, and tell the amateur a little about the chaplet blocks already spoken of. Some of these are merely like a flat-headed nail drove into a piece of wood underneath mould, as in Fig. 27, A representing chaplet, and B the block. Fig. 44 represents one with a radial head; these are used principally for pipes or any kind of work having round cores to be supported in their longitudinal length. Fig. 26 shows a metal one, which is made in various thicknesses, as $\frac{3}{4}$ inch, 1 inch, and so on. They are of such a section, you will perceive they cannot by any means fall out of the casting. Another variety of form is shown in Fig. 28, its chief value being in its broad head and base forming a good support for the core above, and a good base on the mould beneath. Figs. 29 and 30 represent two views of a chaplet, which is one of the best in existence, I believe for large cores, Fig. 29 showing the

side, and Fig. 30 the end view; it is made merely out of two strips of sheet iron fastened together by two short lengths of bar iron riveted as shown at top and bottom; they are made in all widths to suit different thicknesses of metal.

There is one thing, however, which must not be forgotten in regard to these chaplets—the annoyance and vexation they create when put between the core and a finished face; by a finished face, I mean a face of metal which requires turning or planing, etc, breaking the tool edge, and the bad appearance they create in such cases makes it advisable to tell the foreman moulder not to put in any chaplets if it is possible on any finished faces you may require: in some cases it is impossible to do without; but in a great many cases, if specially ordered, the moulders will avoid it, and in their places will securely bolt the core to the top part. For ordinary small work the cores are not bolted, but just dropped into the recess made by the print, and it is only where the cores are suspended by the top part where they require bolting; however, our amateurs need not trouble themselves about the bolting of cores, as the moulders will attend to all that, though it is as well, and all for the best, that they should know all about it.

I hope these few instructions on cores, etc., will clear the way to our amateur making his own patterns as it is a subject, well grasped, will be, I might almost say, as equal in importance to pattern making as the alphabet is to a country's language.

The few remarks I made in my last article upon the ordinary joiner's bench has, I believe, created a wish to go into the matter a little further with particulars, etc. I will here, however, only briefly state a few of the differences, and before long, with our Editor's permission, I will devote a separate article to the subject, and go into it thoroughly. I, however, wish to state that in proposing to overhang the bench top, I take it for granted that you get a longer screw or securely bolt the nut at the front of bench support; if not, you are robbed of the extra width you make the bench top project. I myself have tried a bench as described, and can testify as to the advantages to be derived. In the recess thus formed you can hang up your saws, straight-edges, and all such like appendages, and I believe if once tried you would not alter the bench back again.

[Practical remarks on any points that tend to the improvement of the carpenter's bench are always welcome, both to professional workmen and amateurs. A brief explanation of Mr. Scott's modifications will appear in "Amateurs in Council" next month, but this will be supplemented presently by the paper on the subject promised by Mr. Scott above.—ED.]

(*To be continued.*)

REPOUSSE, OR RAISED METAL WORK.

By H. C. STANDAGE,
Author of the "Artists' Manual of Pigments," etc., etc.

II.—CARADOSSO'S METHOD—SOLDERING BY FUSION—REPAIRS OF HOLES AND CRACKS—METHOD ALTERNATIVE TO CARADOSSO'S — CELLINI'S MODE OF WORKING GOLD MEDALLION.

BEFORE describing the necessary tools, appliances, and modern methods of raising works in sheet metal, we refer to one other old metal worker, one of the earliest, namely, Caradosso da Milano, who executed works in metal in the times of Pope Leo, Adrian, and Clement. The method of this artist was successful, differing from that of Cellini; and as our object is to set before our readers as much practical information bearing on the executive part of our subject, we feel sure that many amateurs will find some suggestions from the method pursued by Caradosso, which we now describe as it is set forth in the translation from the "Trattato dell' Orificeria" (Chap. V.).

"All these articles, which amongst goldsmiths are called smallware work, are wrought with punches and chisels; such as rings, pendants, or earrings, and certain medallions (worn in hats and caps) made from very thin gold plate, on which figures are worked in low, half, and perfect relief."

"Caradosso's method of working with the chisel was more difficult than the usual method. The first thing Caradosso did was to make a model in wax of the object he wished to produce in metal. Having modelled the object in wax, he then filled up the undercuttings with clay, and took a cast of it in bronze.

"Having got this cast to perfection—no easy task—he then took a plate of gold to work on, the thickness of which increased towards the centre, not so much however that he could not easily bend it, and its width was also greater than that of his model; this, of course, was to allow for the lateral contraction due to the aggregation of the particles in those parts raised above the rest.

"His next step was to beat and work the plate to a raised form, and then place it on the bronze model. He then set to work and hammered it with tools or punches, until he caused the plate to assume, gradually, the forms of the figures on the model. In this process his working was very delicately executed, as he only used punches or tools made of birch or wild cherrywood."

Caradosso's method thus differs materially from the process followed by Cellini. The latter, as we have seen, did not have a model on which to place

the sheet of metal he worked on, but simply worked up the reliefs from the flat metal direct, depending on his eye alone to guide him in the accuracy of forms for the figures so raised. Of the two, Cellini's method shows more art work.

In some cases the wooden tools made use of by Caradosso were not strong enough to effect the result he desired; he would then use punches made of iron, being extremely careful, however, that the gold plate should not break, but using his tools with great dexterity on either side of the plate, as occasion required, at the same time striving to render the gold of an equal thickness throughout, in which he was very successful.

When he had brought the medallion to the height of relief he desired, he commenced the forcing of the metal between the legs and arms, and behind the heads of the figures for the purpose of producing the undercuttings. Not content with making these undercuttings as sharp as possible with the punches, he worked at them until he brought the parts so well together that their edges joined. Although the translation does not say so, we presume that he took away from the model the clay stopping with which he had filled up the undercuttings in the wax model; this he would naturally do, as their removal would enable him to define these undercuttings with greater delicacy, and so throw the raised portion into greater relief. The reason he put these clay stoppings in the undercuttings in the model was, to prevent him, when "roughing" out the sheet of metal to the general design, from cutting through the sheet, which he would probably have done. When, however, he had got the highest reliefs raised, and the general contour of the work raised, he could then work at the finer parts with less fear of cutting through the metal. Caradosso was not content, however, with so deeply indenting the undercuttings as described, but when he had worked at them so that their edges joined—(*i.e.*, the edges of the raised parts came nearly together; *e.g.*, let A, B, C, Fig. 5, represent a section of the sheet of metal in different stages; A will represent an undercut portion, as this is further worked in with the punches, the edges, D, E, will be brought nearer and nearer together, as illustrated in B and C)—he cut away the ground which remained under the legs, arms, and other parts of the figures (*i.e.*, he cut through C of the V-like portion, D C E, Fig. 5), as likewise he did also with the remaining parts, which were detached from the field.*

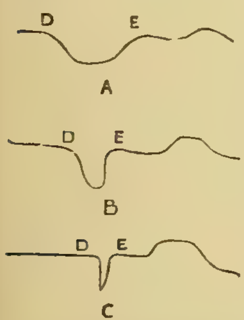


FIG. 5. — INDENTATION OF METAL SHEETS BY CARADOSSO.

When he had arrived at this stage he had practically stamped out certain figures, and cut them out of the plate so that they were really separate. This he did so as to allow of minute undercut parts. It was not his object, however, to leave the relieved parts so detached, he wanted the medallion to be the solid whole, so having thus cut the raised parts away from the ground, he set about joining them together again. This he did thus:—

Soldering by Fusion.—"He took a lump of verdigris in its purest state (not having been previously used for any purpose) the size of a walnut without the rind, a sixth part of sal-ammonia, and as much borax. These he ground well together, and with the addition of a little very pure and clear water, liquefied them in a glazed bowl. When this composition became of the consistence of an oil colour, he used a wire, laid a slight thickness of it upon the before-mentioned parts to be joined (*i.e.*, between the arms and other parts of the figures), and upon this composition of verdigris he placed a little well-ground borax."

The source of heat for melting this composition, also required careful preparation. "He then made a fire of pure unused charcoal, and placed his work in it, arranging the ends of the charcoal so that they turned towards the parts he wished to join, for the reason that the ends breathe or puff out a little; he also adjusted some pieces also over the work in the manner of a grating (*i.e.*, across each other like laying sticks of wood in laying a fire in the grate), taking care, however, that they should not touch it (*i.e.*, the metal work). When the metal became of the same colour as the fire, he began blowing with a pair of small bellows, in such a manner that he caused the flames to play all around his object. Should, however, the stream of wind be too strong, a danger would be caused by the work melting and being thereby spoilt; for this reason he observed the greatest care, and watched for the glittering and moving of the first pellicle, as it is called, or outer coating of gold. As soon as this took place, he quickly sprinkled his work with a little brush dipped in water, and in this manner the parts became most excellently joined without any solder at all." For the composition in reality was simply a flux to melt the gold. By this means he reunited all the parts he had previously separated, and the piece of metal he worked on was once more whole; the fumes given off by the charcoal and the fusion of the flux, of course, dis-

* To allow this method of working to be done successfully, the plate should be made of the best gold, of at least 22 carat, that of 23 carat being too soft for working, and that of 21½ carat too hard and dangerous in soldering.

coloured the gold, so to regain its colour he placed it in vinegar, thus, "having by the above method (which is not called soldering, but is really bringing the whole work into one piece, for such is the power of the verdigris in company with sal-ammonia and borax, that only the first pellicle, or outer coating of the gold, is by their agency moved; and being slightly melted, these outer surfaces of the gold join in such a means that the whole becomes equally entire and solid)—Caradosso, having thus joined his work, placed it in very strong white vinegar (acetic acid), adding thereto a little salt, and so left it a whole night, the effect of this was, that in the morning he found it (*i.e.*, the gold object) whitened and cleaned from the borax. He next took some stucco * with which he filled the whole of his work, so as to be able to work on it (that is, he formed a bed of this stucco on which to place the object, just as the modern repoussé worker forms a bed of pitch [see *infra*]) with his chisels or punches, which he had provided of all sizes, gradually diminishing from large to small, and made without a cutting edge, having to be used for bruising or denting, and not for cutting away."

In working the metal, some small holes or cracks will unavoidably occur; the method of joining it with verdigris, etc., above described, must not, in these cases, be adopted, but a solder should be used, as follows: Melt six carats of pure gold, and, when liquefied, add of fine silver and copper together one carat and a half. With this solder, or stopping, the holes or cracks made in working should be filled up, and every time a soldering takes place some of this stopping should be put on the holes previously so stopped, so that the subsequent soldering may not cause the previous one to run; all parts of the work being thus soldered, he again placed it on the stucco and re-worked it with care and patience till he had brought it to perfection. This is the whole of the method followed by Caradosso.

A method slightly different to Caradosso's is this: When the model has been made in wax, and the design determined, a plate of gold of the form before described (viz., thicker in the middle than at the sides) should be worked slowly on the reverse side with the large chisels or punches, bulging it out roughly, or stretching, in the form of the wax model. Working in this way, the bronze model used by Caradosso is not required, and the work would thus be much advanced in less time than the bronze model could be cast; moreover, the slight staining of the gold caused by the bronze every time the metal is heated, is not required to be removed, as it is in the other case, by glass-dust (a very useful material, as it removes all stains of fumes from the bronze). By following the above method the artificer will avoid those impediments specified, and will be quickly able to reheat his work.

We have already described Cellini's method of working a sheet of gold; the following short account of a gold medallion he wrought serves to contrast forcibly his method with that of Caradosso's, just given:—

"A Siennese gentleman, named Girolamo Muretta," writes Cellini, "commissioned me to make a gold medallion for him. In this I introduced a Hercules accomplishing the labour of tearing open the jaws of the lion. I made these figures in whole relief, and so much were they detached that the heads hardly seemed to touch the ground, so slight were the junctions. This piece I executed without making a bronze model, but by striking alternately on the face and on the back of the plate. With such patience and care did I finish it, that it gained me this reward (and I say it with the greatest satisfaction), that the most excellent Michel Angelo Buonarroti condescended to come over to the chamber in which I worked to see it; as is known to many worthy artificers who were present on the occasion. This occurred at Florence, in the year 1528. This most wonderful man having examined my work, spoke of it in these (his own) terms. I do not, however, wish," says Cellini, modestly, "therefore to make these words a matter of merchandise, or to exalt myself, as many artificers with unbridled ambition are in the habit of doing, adopting in all their discourses expressions purporting to have been used by him; it having been my practice ever to strive rather for the reality than a mere appearance. Having, as I said, examined with a careful eye the outlines, the muscles, and the attitudes of these small figures, he said, 'If this little work, finished with that care and beauty which I observe in it, had been carried out in a large size, either in marble or bronze, we should have seen a marvellous work; and to my mind, I do not believe the ancient goldsmiths could have executed their works with more excellence than I find in this.' So much did these words excite me to work, that I set myself to make large figures, and more so from its having been told me that Michel Angelo expressed himself to the effect that one who had completed with such perfection a small work would not, in one of a larger description, have arrived at the same happy result. Not for the purpose of overthrowing the opinion of such a man, but so that I might, by study and practice, avoid any impediments, as in the carving in marble, or in the casting in bronze of large figures, might have prevented me from attaining that true and esteemed manner so much sought after in

* This stucco he made of Greek pitch mixed with a little yellow wax and some well pounded brick.

these arts, did I therefore set myself to carve and cast large subjects in marble and in bronze."

Here was worthy emulation! Fired with enthusiasm by the words of so great a master in arts, Cellini, who was already proficient in his particular line, still looked upon himself as but a pupil in comparison, and, with all the enthusiasm of a student, still sought to attain greater excellence.

(*To be continued.*)

NOTES ON NOVELTIES.

By THE EDITOR.

11. Skinner and Co.'s Veneer Album. 12. Messrs. Skinner and Co.'s "Eclipse" Boxes of Fretwork Tools and Materials. 13. Messrs. Skinner and Co.'s Price List and "Eclipse" Designs. 14. Edwards' Desiccated Soup. 15. Britannia Company's New Price List. 16. Mechanical or Acoustic Telephone. 17. Messrs. R. Melhuish and Sons' New Stop Chamfer Plane. 18. The "Utility" Metal Garden Labels and Indelible Ink. 19. D. Witt and Palmer's Veneers and Timbers. 20. Zilles' New Lists, Designs, and Drill Bits.

I INTIMATED last month that I had left many things unsaid that I ought to have said, owing entirely to want of space. I will, however, do my best on the present occasion, as far as space will allow, to clear up all arrears and to make a clean sweep of everything that I have been requested to notice, and which now lie in a veritable heap before me, mutely reproaching me for my shortcomings.

11. *Skinner and Co.'s Veneer Album.*—I cannot do better than make a beginning with Messrs. Skinner and Co.'s Specialities—specialities from *East Dereham, Norfolk*, which are worthy of attentive consideration. First, among these is the "Veneer Album," prepared and sent out by this firm for 5s. 6d., and well worth the money it is to any amateur who is curious about the various kinds of woods that are used in carpentry, cabinet work, and fret cutting and turning. At first sight, you look on a compact case covered with scarlet cloth, held together by a band of black elastic, and lettered in gold. This case when closed is 8½ inches long and 8 inches broad, with a thickness of about ⅝ inch. Open it and you will find specimens of twenty-eight different kinds of wood arranged in alphabetical order. Three pieces of each kind of wood are given, showing (1) the wood in its natural state; (2) its appearance when varnished; and (3) its appearance when polished. In one case—that of pear wood—the wood is shown under three conditions when ebonised as well as in the natural state without stain. Of these specimens Messrs. Skinner and Co. say in the printed notice posted with the case:—"All the varnished samples in this album are varnished with our *light varnish*, and of the polished samples, white chestnut, holly, lime, and plain maple, are polished with our *white polish*. Cherry, Australian cedar, brown oak, Honduras and Rio rosewood, teak, American and English walnut, are polished with our *dark polish*, and American and English ash, birch-canary, pencil cedar, Spanish chestnut, mahogany, bird's eye maple, light oak, orange wood, pear, satin wood, ebonised pear, saquoia, sycamore, and tasso, are polished with our *transparent polish*. The pear is ebonised with our *Ebonising Solution*. Varnish will be found to work much smoother if mixed with pale glaze." I quote this because the names of the woods of which specimens are given in the Album are stated therein, and Messrs. Skinner and Co.'s different polishes, varnishes, ebonising solution, a glaze, which are sold at prices ranging from 7d. to 1s. 3d. per bottle, and are sent post free for 3d. per bottle extra. Details of prices are given in the case, or album. This will be found especially useful to amateurs in enabling them before commencing a piece of work, to judge of the appearance of the article when completed, either in its natural state and when varnished or polished, and thus to determine, even before beginning, the style of finish they would prefer. It is also helpful in making a choice of wood for any piece of work. I strongly recommend Messrs. Skinner and Co.'s Album to all amateur wood-workers.

12. *Messrs. Skinner and Co.'s "Eclipse" Boxes of Fretwork Tools and Materials.*—For the convenience of beginners in fret cutting, Messrs. Skinner and Co. are now sending out very handy boxes, containing the various articles and materials necessary for a first attempt, called the "Eclipse" boxes. It is a useful and convenient method of sending out things of this kind, because the fret-worker not only has the wherewithal to begin with, but he has also the means supplied to him of putting away his work and tools when done with, in a repository specially designed for them, and thus guarding against loss or damage. The boxes are made in two sizes, and one, with contents, as follows:—

No. 1, 14 inches by 12 inches by 3 inches, containing 12 inch steel frame, 6 inch Archimedean drill with brass handle and three bits; 6 dozen saws, 2 files, screws, nails, iron cramp, 4 designs with sufficient planed fret wood: price 5s. 6d., or carriage free, 6s. 3d.

No 2, 16 inches by 15½ inches by 4 inches, containing a superior 14 inch steel frame, with tension screw and screw in handle to adjust the frame for using broken saws; 6-inch Archimedean drill with brass handle and six bits; 6 dozen best Swiss saws, 6 files assorted; wood cramp and cutting board; an assortment of screws, hinges, wire nails with 6 designs, and sufficient planed fretwood; price 10s., or carriage free, 11s.

The boxes themselves are made of oak or similar hard wood. The No. 1 box sent as a specimen contained everything mentioned in the list except the iron cramp which had melted or escaped in transit, I suppose. I mention this as it is well that Messrs. Skinner and Co., or their representative entrusted with the task of sending out goods, should see that everything is as per list. Pill-boxes, whether of chip or cardboard, are cheap enough; and I strongly recommend Messrs. Skinner and Co. to send out the small French wire tacks and tiny screws that form part of the outfit in these boxes.

When wrapped in soft paper as they came to me, the paper is liable to break, and the tacks or screws contained therein to get scattered on the table or floor, as they did with me, which entails the somewhat tedious task of picking them up again, and probably at a loss. The steel frame, saws, drills, files, etc., are all good and cheap at the price asked for them collectively. The wood, too, amounts to something like 2 square feet; and the designs, although simple in themselves, are well calculated for making a beginning in fret-cutting, and the most accomplished of fret-sawyers must have been beginners once.

13. *Messrs. Skinner and Co.'s Price List and "Eclipse" Designs.*—The Price List just issued by Messrs. Skinner and Co. at 4d. leaves nothing to be desired, as it contains every kind of information that an amateur wood-worker in the fancy way can desire with regard to tools, machines, appliances, materials and fittings of all kinds for fretwork, turning, and carving. Buyers at home and abroad are also furnished with much useful information, with respect to mode of making remittances to the firm, the rates for carriage per parcel post, post office insurance and compensation for loss in transit, or damage, foreign and Colonial parcel post and other desirable memoranda of this kind. All amateurs should send for this catalogue, as many special articles are mentioned in it which would not be found in the shop of any ordinary ironmonger. Messrs. Skinner and Co., I may say, are wholesale timber merchants, and I recommend any amateur who may be in want of wood of any particular kind to apply to them for it, for I am sure that if they have not got it in stock, they would either get it for the applicant, or put him in the way of getting it, or, failing this, they would tell him what wood could be best used, instead of the wood he wants, but which he may be unable to get. Lastly, let me say that many of the latest "Eclipse" designs are for articles of furniture which are extremely useful as well as highly ornamental. Among these I may call attention to No. 186—a Window Flower Stand, 26 inches long, 11 inches wide, and 30 inches high, price 2s., for which—I mean the stand, not the money—a framing of wood is supplied to those who cannot make it for themselves on terms which will be named to any applicant; and No. 188, a Window Blind, at the same price, consisting of three panels of birds surrounded by ornamental tracery in the Japanese style. With this designs are given for intermediate strips in order to adapt the blind to any size of window, by introducing them between the panels.

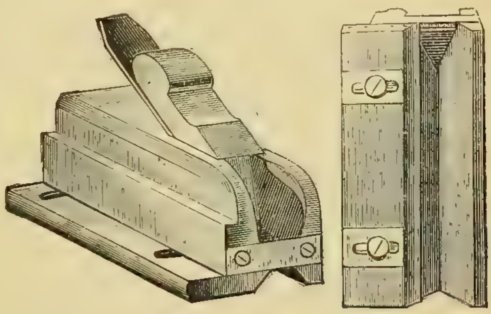
14. *Edwards' Desiccated Soup.*—This is the first time I have been asked to pronounce an opinion on anything to eat or drink in AMATEUR WORK, and I have much pleasure in saying that Messrs. Frederick King and Co., Limited, 26, *Waring Street*, *Belfast*, and 6, *Bishopsgate Avenue*, *London*, *E.C.*, are the sole manufacturers of a preparation called Edwards' Desiccated Soup, which keeps good any time and in all climates, and makes a most nutritive and delicious soup in a few minutes. To the latter part of this assertion I can give unqualified testimony. I received from the above-named firm a 1 oz. packet, costing one penny, as a sample, with instructions to stir the contents into three-quarters of a pint of cold water in a saucepan, boil for fifteen minutes, and then flavour (*i.e.*, add pepper and salt) to taste. The instructions were followed to the letter, and a basin of delicious soup, mid-way in substance between thin soup, as represented by gravy soup, and thick soup, as represented by pea or lentil soup, was the result; its aroma appealing to the nostrils as powerfully as its flavour commended itself to the palate. The makers say that "a few drops of sauce may be added with advantage;" but, for my part, I did not want any sauce with it. It may be made, it is said, with boiling water, like cocoa, but it is better to boil it if possible. The soup consists of beef and vegetables in a highly concentrated form. A pound tin, which costs 1s. 3d. and makes six quarts of rich and excellent soup, represents the essence of 7 lbs. of beef and 5 lbs. of potatoes and other vegetables, forming a most perfect diet for the healthy, as well as for those who have been weakened by and are recovering from sickness. It has been tried in hospitals in India with complete success, and was found better in its effects than ordinary beef-tea. I can recommend its use to clergymen in country districts for the poor, and for themselves too, and to all who have the superintendence of soup-kitchens for the relief of the poor in winter. It will be found infinitely superior to the traditional pinch of curry powder in hot water—as superior to it, indeed, as light to darkness. And to emigrants, dwellers in the backwoods, travellers, officers and soldiers on a campaign, and to sportsmen whose pursuit of game or fish may carry them into districts where the commissariat is but badly looked after and scantily supplied, I can recommend it as an article intrinsically good in itself, and worth more than what the manufacturers in their modesty and humility ask for it.

15. *Britannia Company's New Price List.*—The Britannia Company, *Colchester*, *England*—I add England for the benefit of Colonial readers and others in foreign parts, for which I presume the Company uses it in its address—has just issued, price 6d., a new "Price List of Engineers' Tools, Amateur Lathes, etc." This pamphlet, which consists of thirty-two large 4to pages, and wrapper, gives a full and complete account of all the appliances and machines in the form of milling machines, lathes of various kinds, slide-rests, chucks, mandrels, toolholders or cutter bars, gear cutters, lathe-carriers, drills, twist-drills, drilling-machines, lathes, planers, saws, fret-saws, grindstones, band-saw machines, and mortising-machines manufactured and supplied by this Company. It makes mention also of all the latest specialities added to the Company's stock, many of which have been recently noticed in these pages. Every amateur who possesses a lathe or fret-saw, or who is about to buy one, should first send for one of these price lists.

16. *Mechanical or Acoustic Telephone.*—The Woodhouse and Rawson Electric Supply Company of Great Britain, Limited—whose address does not appear either in the letter they write to me or the prospectus which accompanied it, for which reason I am unable to give it—send a short account of a new telephone called the Mechanical or Acoustic Telephone, which they are now supplying. It claims to be the simplest, best, and cheapest yet produced,

affording the best possible means of communication between any two points that are at some little distance from each other. It is said to be easily fitted up, and cannot get out of order. Electrical batteries are not necessary. One single instrument serves both as a transmitter and a receiver—that is to say, of course at one end of any line of communication. It need not be taken in the hand or removed from its position, and speakers and listeners may stand at a moderate distance from the instrument. The line guides which are supplied enable the line to be carried to any corners in any position. It is especially suitable as means of communication between one part of a building and another, as well as between places at some distance from each other. This telephone is a development of one of the earliest forms of these appliances, whose principle, until recently, was regarded as being devoid of any practical utility. For many years the principle upon which all acoustic telephones have been worked has been similar to that of the "Lovers' Telegraph" of the seventeenth century, which consisted of two cups connected at a distance by a simple cord attached to a membrane covering the end of each instrument. The appliance in the form in which it is produced by the Company has a very large field of practical usefulness. It is free of all telephone patents, and no electricity is employed to work it, while for the distance over which they are required to work they are louder and more distinct than any electrical telephone. The price per set ranges from £3 3s. upwards.

17. *Messrs. R. Melhuish and Sons' New Stop Chamfer Plane.*—The annexed illustration gives an excellent representation of a new stop chamfer plane that has been recently introduced by Messrs. R. Melhuish and Sons, 85 and 87, *Fetter Lane, London, E.C.*, and is supplied by them for 7s. That part of the illustration which lies to the left affords a perspective view of the plane as seen from the front, and the part to the right, a view of the sole of the plane. From these its construction can be easily recognized, and its purpose and action readily understood. The body of the plane consists of a kind of box—if I may so describe it, for the purpose of making myself clearly understood—which is closed behind and open in front, except across the bottom, where a metal plate of no great width is screwed to the sides. One of the sides, as may be seen, is lower than the other. This side is bevelled at an angle of 45°, and forms part of the fence or guide that is necessary to fit against and glide along the arris or adjacent sides of a piece of wood that is to be stop-chamfered. The other and shorter side is perfectly level along its base and wider than the other, to admit of the attachment of a piece of wood, also bevelled on one edge, at an angle of 45°, which forms the other side of the fence. This piece is attached to the bottom of the left side of the plane, looking at our illustrations, by two clamping screws working in two parallel slots cut in fence at right angles to its length. By this arrangement the plane is rendered adjustable, for chamfers can be cut to it with a surface varying in width from the smallest possible to the greatest distance to which the movable fence can be removed from the fixed one. The principle on which the plane is made is that of the bull-nosed plane, the object of which is to enable the workman who is using it to continue the operation of planing to the greatest possible extent. When using Messrs. Melhuish and Sons' New Stop Chamfer Plane it will be found that the plane-iron gets as near as possible to the end of the work, the portion remaining untouched by it, between the end of the planed surface and the stop, being no more than the thickness of the piece of the metal screwed on in front of the plane. While speaking of this, the newest speciality that has been added to Messrs. R. Melhuish and Sons' large and valued stock, I may say that this enterprising firm now keep Norwegian gimlets which are supplied at 4d. each. They have also an improved form of the twist gimlet, the gimlet having three turns in it instead of two, which enables it to clear itself all the more easily and expeditiously. The shank and groove of the Norwegian gimlet has also been modified at a short distance above the point, so as to increase its cutting power and to enable it to clear itself more quickly. I will also remind my readers who wish to do a small amount of carving in wood, either in connection with fret-sawing or otherwise, that Messrs. R. Melhuish and



MELHUISH AND SONS' NEW STOP CHAMFER PLANE.

Sons keep some very good and very useful carving tools, nicely made, straw-tinted, and well set in good handles which are supplied, ready for use at 8s. per dozen, assorted, or at 21s. 6d. for full set of thirty-six. It must be understood that they are not full-sized tools, which I prefer myself, because they are larger in every way, and, therefore, more comfortable. For general work, however, and especially for carving, in connection with fret-cutting, the smaller tools are quite as effective as the larger ones.

18. *The "Utility" Metal Garden Labels and Indelible Ink.*—Some of my readers have occasionally taken me to task for speaking of matters pertaining to gardening in AMATEUR WORK, under the idea that garden work does not come fairly within its scope. I do, however, but adhere to the promise made in the prospectus that heralded the appearance of Part I. in finding a corner for it now and then, and I have now much satisfaction in noticing the "Utility" (Registered) White Metal Garden Labels and Indelible Ink, manufactured only by the Leicester Utility Company, 62, 64, and 66, *Laxton Street, Leicester*, and sold by Messrs. Viccars Collyer and Co., Nurserymen and Seedsmen, *Central Hall, Leicester*, which fact alone is a powerful testimony in their favour. The labels themselves are apparently made of rolled zinc, or at all events of a metal which much

resembles it, and are about $2\frac{3}{8}$ inches long, and $\frac{5}{8}$ inch wide, pierced with a hole at one end, for attachment by means of string to any plant, etc., and rounded at the corners. They will be found superior to the general run of labels on account of their cheapness, durability, and convenience. A sample box containing twelve labels, a bottle of indelible ink, and a suitable pen, which, by the way, is a quill pen, is supplied post free for 1s., but larger quantities may be had at lower rates. The ink should be shaken before it is used, and the writing in every case done with a quill pen. Before writing on the label see that it is clean and free from grease. As soon as the writing is dry the label may be tied to the plant, whose name has been written upon it, and it will be found that exposure to the weather tends to preserve and strengthen the writing instead of obliterating it. String is recommended for tying on the labels, as wire may injure the bark of some trees when it happens to be somewhat tender. The systematic labelling of plants and trees is a practice of great value, and ought never to be neglected—but the advantages are scarcely appreciated as they deserve. Probably this arises from the difficulty experienced in getting a suitable label, and one which can be used at any time without trouble, and therefore persons trust to their memories. But memories fade, and after a time particulars are forgotten. By using these labels a permanent record is made and attached to the tree, which can be referred to at any time, for instead of fading with time, the impression, as it has been said, becomes deeper and more intense by exposure to the weather.

19. *D. Witt and Palmer's Veneers and Timbers.*—The question has been often put in AMATEUR WORK—"Where can veneers of different kinds of woods be purchased? To this inquiry a practical answer is given by the price list, now lying before me, of Messrs. D. Witt and Palmer, English and Foreign Veneer and Timber Merchants, *Drummond Steam Works and Offices*, 168, 170, *and* 172, *Drummond Street*, *Euston Square*, *London*, *N.W.*, and 1*a*, *Upper Rathbone Place*, *Oxford Street*, *W.* Veneers of every description, both of natural wood and of dyed wood of all colours, including dry ebonised black wood, are supplied in various lengths and thicknesses by this firm, who will, I am sure, readily send their price list, which is an "approximate price list of articles in most general use," to any applicant, and afford such information as it may be in their power to give with regard to any particular kind of foreign timber that may not be mentioned in it. The list includes a great variety of useful and ornamental woods, and prices are given for logs, planks, and staves, when the wood is supplied in this form, as well as for veneers. I note that the firm will undertake to execute any orders for either home or foreign goods for pianoforte making or cabinet making, to the best advantage of their customers, charging only a small percentage on invoice prices.

20. *Zilles' New Lists, Designs and Drill Bits.*—The new List—No. 30, price 2d.—of designs of various kinds and infinite variety, just issued by Mr. Henry Zilles, 9, *South Street*, *Finsbury*, *London*, *E.C.*, contains many examples of work in fret-sawing, carving, etc., of great beauty and artistic excellence. The price charged is so low that any amateur may procure one, and select any that may seem to meet his requirements. The designs are, of course, in miniature, but the prices of the full-sized sheet, or sheets, in which the design from which the work to be executed is given, is indicated in the price list. Some designs which have been recently sent me by Mr. Zilles, but which do not appear in the list to which I have just referred, are very beautiful. Among these is No. 98, A Wall-basket, in which figures of animals and ornamental tracery are so well blended together as to overcome, in this instance, at all events, my objection to the introduction of birds and beasts into fretwork. No. 126, a Vase, with which is included a Jewel Stand, is equally good. So is No. 74, a Cabinet for Refreshments; and No. 83, a very handsome Chandelier in the style of No. 126, to which reference has just been named. The preceding are for fretwork; for carving the Fancy Box, Beer Mug, and Calendar, given in No. 646; and the Picture Frame and Clock Case, with some smaller articles, given in No. 648, are well worth reproduction by the Amateur Wood Carver.

I have also received from Mr. Zilles some specimens of very small case-hardened drills, which are supplied at 1d. each, and which appear to be most desirable for fine work. About these drills and their management Mr. Zilles makes sundry remarks, which I reproduce for the benefit of those who know little or nothing about softening and hardening steel, although to many they will be a twice-told tale:—

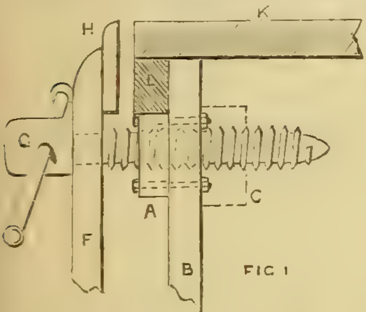
"Enclosed," writes Mr. Zilles, "please find a few samples of drill bits, fine and medium. As, in spite of great care, the fine drill bit will break now and then, and the filing of it not being possible, owing to the hardness of the steel, the following method of softening and hardening the above tool, in case it should not be broken off too far, will make it fit for use again: The hardness of the steel decreases by gradually heating it. When, however, it is heated till it glows, and then allowed to get cold slowly, it will become as soft as it was before it was hardened. In this manner it is easy to give articles made of steel any desired degree of hardness which lies between the natural softness of the metal of which they are made, and the hardness of glass. For this purpose the different colours (oxidation of surface) that will appear in consequence of the increasing heat, will serve as a guide. At first there will appear a pale yellow, oats and straw yellow, gold yellow, dark yellow, then a rosy, purple, violet, dark blue, light blue, and sea green, colour; after that the steel will become white or light grey, and a moment afterwards the principal colours will appear for the second time in the same way, but only for a very short time; lastly, the steel will glow and become quite soft. The yellow colour, in one or other of its degrees, is generally given to those tools which serve for working in metal. The purple, violet, and dark blue colours, indicate a degree by which the steel may already be filed, and is perfectly flexible and elastic (as used for springs, saws, etc.) When the desired colour has been obtained, the steel must be put into the water quickly. The heating may be done in the open fire, glowing sand or coals. I may also mention that the boring of holes should be done on a piece of soft wood, and that deal is best adapted for the purpose."

AMATEURS IN COUNCIL.

For "Instructions to Contributors and Correspondents," see page 44 of this Volume, or Part 60, page 44.

Modification of Bench Screw.

*** In "Pattern-Making for Amateurs," page 83 of this Volume (or otherwise Part 61), Mr. Arthur J. Scott describes some modifications of the bench screw and carpenter's bench, which he finds to be of great service to him. For my part I did not exactly comprehend the method of construction to be adopted, from his description, and thinking that many amateurs might be at a loss, like myself, to see precisely what is intended, I asked him to make the matter clear by diagrams, stating



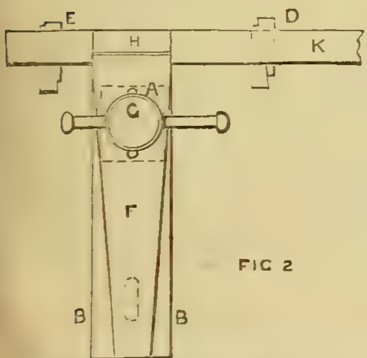


Fig. 1.—Side View or Section of Modification of Bench Screw. Fig. 2.—Front View, also showing Disposition of Wedges in Bench.

References to Letters in both Figs.:—A, Nut for Bench Screw; B, Bench Leg; C, Ordinary position of Nut shown by dotted lines; D, Handy Wedge for Short Timber; E, Ditto for Long Timber; F, Loose Leg for Bench Screw; G, Bench Screw; H, Gripping Piece for Bench Screw; K, Bench Top; L, Making up Piece.

that I did not see how his plan was carried out, unless a piece of wood was screwed to the front of the bench, having its outer surface flush with the edge of the top, which, according to his modification, is to project 2 inches beyond the front. He writes:—"Your supposition is correct in regard to the bench screw, which, at first sight, appears so difficult to manage, but in practice it is not so. In the sketches given you will perceive from Fig. 1 that the nut, C, is fastened by bolts connected with the bench leg, B, or if the screw is a long one it can be fastened at the opposite side as usual, as shown by the dotted lines, E. The rest explains itself in regard to the second wedge. Fig. 2 shows the position very clearly. I find wedge F very handy for planing work, that is, of not extreme length.

Pendulum for Eight Day Clock.

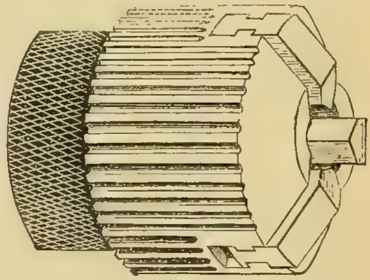
Jack Leigh.—Get from any Clock Tool Warehouse the castings or stampings, about 4 or 5 inches diameter, of a pendulum bob, and a piece of brass about 6 inches long, $\frac{1}{4}$ by $\frac{1}{8}$, same as used for spring pendulum rods, a yard of iron wire, about $\frac{1}{8}$ inch diameter, and a piece of verge watch spring. Cut off about $\frac{3}{4}$ inch of the brass, drill a hole near the top through the thin way of it, and saw a slit up three parts the length, the long way, pass the spring up the slit, drill a hole through brass and spring, and rivet it. Now measure from the back cock to the crutch, get a thick piece of brass and fit in the crutch, about 1 inch long—it must have a little shake in the crutch when finished—saw a slit one end about $\frac{1}{4}$ inch deep, pass in the other end of the spring, and see that when the small piece of brass is resting on the cock, that the crutch is in the middle of large piece. Now drill and tap a hole in the other end of large brass, and tap end of wire to fit. Next file a notch in each half of the bob castings so that the piece of brass will slide up and down in it smoothly. Tin both pieces on the inside. Scrape a piece of damp soap, and smear the stick of brass plate in the notch, bind both halves together (first drilling a $\frac{3}{8}$ or $\frac{1}{2}$ inch hole in one half), and fill with lead. When cool, draw out piece of brass, cut off to about length of ball, drill and tap a hole at each end, screw in one end the piece of wire with spring, etc., on, and in the other a piece, tapped for about 2 inches, with a nut fitted. Now put on the bob and measure from centre of bob to middle of the piece of spring at the top 39 inches, put regulating nut in the middle of the 2 in. screw, hang on in its place, and regulate. Vienne Regulator cases run about 28 inches, by about 9 by 2 inside. Pendulum about 20 or 22 inches, with 5 or 6 inch ball, brass front, zinc back; case being merely a long narrow shallow box, with glass door and sides, ornaments top and bottom. English cases vary—some running 8 feet—all that is necessary being to give weights far enough to drop that the clock may go eight days. Mine measures: height of head, 21 inches; length of plain body, 42 in.; base, 21 inches. Total from floor to top, 7 feet.—A. B. C.

Newspaper Cuttings.

J. H. R. (*Anglesey*).—You ask: "Is there any means of reproducing newspaper cuttings instead of having either to copy the paragraphs or cutting them out and pasting into books?" To this I must reply that I am aware of no means of preserving a newspaper cutting or the information contained therein, except by one or other of the two modes specified above. An ingenious system for the preservation of newspaper cuttings, is described in "My Repository for Newspaper Cuttings," Vol. V., page 12 (or Part 48), but this involves the use of the scissors; and you will find in Vol. IV., page 450 (or Part 45), a short article, entitled, "How to Split Paper," which will be of use when you wish to preserve matter printed on both sides of a piece of paper.

The Four Dollar Drill Chuck.

S. M. L. (*Goderich, Canada*).—My experience with this sort of chuck is very similar to yours. Unless the drill is a very small one, some auxiliary power is required for tightening up. The mere grip of the hands is not sufficient for large sizes, *unless the jaws or dogs are properly hardened and kept sharp*. This is the main point of a good grip, and to further secure this the shank of the drill must be soft, so that the dogs may bite into it. The scroll thread which actuates the dogs must also be kept well oiled. As for the truth of the chuck, I have nothing to say against it. Those I have seen and used ran true, but it is likely that yours may be erring in that respect. To test it properly, chuck a piece of metal, bore it to fit the shank of drill chuck, and, without removing or in any way altering the piece thus prepared, insert the drill chuck and



THE FOUR DOLLAR DRILL CHUCK.

test it. If it doesn't run true, the fault is its own, and it should be returned to the maker. The shanks of the drills must be turned parallel in all cases, to give fair play to the dogs or jaws of chuck.—Olla Podrida.—[The engraving that accompanies your letter is reproduced in the accompanying illustration, which is evidently taken from the price list of an American maker. In asking questions about tools and appliances, it is always desirable to give name of chuck and maker. I fail to find it figured in Messrs. Churchill and Co.'s Catalogue of American Machinery and Tools.—Ed.]

Stereotyping.

J. H. (*Canonbury*).—I have a paper in hand, which will appear very shortly, giving full instructions in stereotyping. This will enable yourself and all amateur printers to do work of this kind for themselves. I am glad to learn that you have been successful with the "Shaving Glass," and that your success "in more than one case, has gained a fresh subscriber to Amateur Work."

A Suggestion.

F. S. (*Folkestone*).—Your meaning is to index each notice in "Notes on Novelties" separately as a distinct item, and place them in alphabetical order. The index is very heavy at present, but I will see what can be done.

Fret-cutting: How Done.

GREENHORN.—You ask: "Having procured the design and the wood, what is to be done? Should the design be pasted on the wood? or how is it to be cut?" I take it that your difficulty lies in the attachment of the design to the wood. Paste it on, or if you wish to preserve the design, make a tracing of it, and paste the tracing on the wood. When the work of cutting is finished, the paper that is on the fretwork may be easily removed with a small sponge and a little warm water. To attempt to cut out the design before pasting it on the wood, would do more harm than good.

Reflecting Telescope; Holes in Lamp Shade.

C. W. N. (*Southgate*).—The $\frac{1}{25}$ of an inch hole in the lamp shade serves as a finder for the more minute aperture. Having placed the former in the proper position, a slight rotation of the shade carries the smaller $\frac{1}{300}$ inch puncture into its proper place, and with this latter hole the actual testing is done. For "beating," in footnote of page 554, read "treating." It is, as you suggest, a misprint.—E. A. F.

Scroll Saw for Circular Saw Bench.

H. A. S.—Please see latter part of preceding reply on band saw. Thanks for encomiums on saw bench. If you find trouble with any of the details, don't be afraid to ask a question, as I take a pleasure in helping those who actually take a thing up and work it out. — OLLA PODRIDA.

Lettering on Cloth.

L. W.—The lettering on cloth is very simple. If hand letters are used make a blind impression first of the lettering, then glaire the lettering on the cloth, allow to dry, lay on the gold, and rework with heat. I do not know of any one who would teach you, unless your local binder would.—The Author of "Bookbinding for Amateurs."

Painting Dog Carts.

W. L. (*Golborne*).—Only sandpaper the wheels, as you can do nothing more with them. Do not attempt to get the paint or varnish off. Mix the lining colour thick as cream, transfer it to the palette with the liner. Then dip the liner into the dippers to thin the colour on the palette a little. Line with this colour until all is taken off the palette, then go on as before. Sometimes the liner will get stiff with the colour drying on it; dip the liner into the dippers, and press it by drawing between the thumb and finger until cleansed. Sable liners, when new, are very stiff, and want getting in order by working to make them pliable. Sable hair liners are dearer than camel hair, but the camel hair are better for W. L. to use, as they are nice and soft to work with. An ordinary paint brush $1\frac{3}{4}$ inch across the bristles will be the brush to paint with. After using it in paint for a while, it will make an excellent varnish brush for the body or wheels. The flat brushes you mention are only intended for panels. It is impossible to paint a dog-cart with a new brush, and it would be impossible to varnish with a new one, as all the brush marks would be shown, besides bristles coming out of the brush. You must look out for some second-hand brushes, half-worn, or nearly so; you will not be able to buy a varnish brush a little used, so you must cleanse a paint brush well. The room in which you varnish must be warm, and the bottle with the varnish kept in the same temperature. I have just completed a dog-cart, body all black, wheels and shafts, springs, painted dark Brunswick green, with centre line of vermilion, same as Fig. A in November, Part 60. As a rule the carriage work is painted to match the upholstery. If the wheels are painted any colour besides black, the frets on the nave must be painted black. After the body has been varnished, in a week afterwards it can be put in a draughty place, this will dry and harden the varnish better; also, if you like dash cold water on it, but be sure to wipe off quick, so that the water does not dry on the varnish, or else it will mark afterwards. Wipe off with chamois leather.—W. P.

Mildew on Looking-Glass.

OLD SUBSCRIBER.—If the "mildew or damp" effect is on the silver, nothing can remedy it but re-silvering. If the dulness is on the glass surface, it may be polished off with a little putty powder (obtainable at the chemist's) applied by means of a small pad formed of soft thin felt strained over a piece of cork. A little damp and patience will restore the polish.—E. A. F.

Carbon Process in Photography, etc.

A. B. S. (*Edmonton*).—(1) The carbon process in photography shall receive attention in due course. (2) I hope you will be successful in making apparatus for enlarging, and I shall be pleased to hear your experience in the matter. (3) I cannot tell you precisely when "How to Build an Inductorium" will appear. (4) As Mr. Edwinson has frequently said, instructions will be given in course of time for nickel plating. (5) I am sorry that the fact that no instructions have yet been given in Electrotyping has caused you to be surprised. One cannot do everything at once, and something must wait. (6) A practical answer awaits the query of A. W. H. (*King's Lynn*), about making a violin case, and there will be no necessity for troubling Mr. Allen, who is now devoting considerable time and attention to Cheiromancy and Cheirosophy.

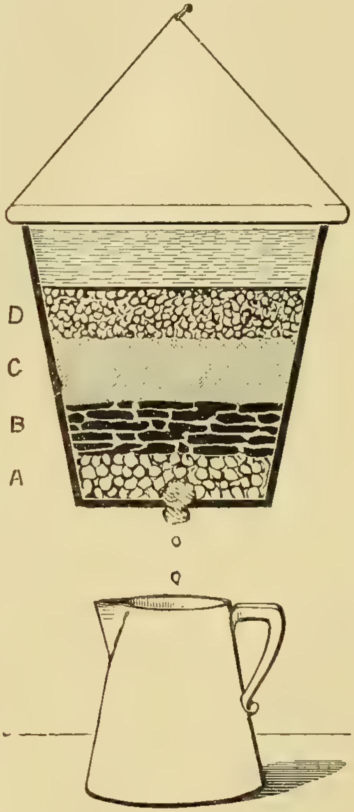
Fastening Rubber Tyres.

E. E. P. (*Marlboro'*).—You will find instructions for fastening rubber tyres to the wheels of bicycles and tricycles in Chapter IV. of a series of papers entitled "Velocipedes: Their Construction and Use," by A. Stephenson, Vol. II., page 168 (or otherwise Part 15).

INFORMATION SUPPLIED.

A Cheap Filter.

C. A. P. writes in reply to ROSEWATER (page 48 of this Vol.):—"First obtain a large size flower pot, then fit tightly into the bottom hole a small piece of sponge. Now shake in some coarse gravel, A, and on this place a layer of charcoal, B, then pour in fine sand to the depth of about three or four inches, C, and then some more gravel, D, and finally place on the top a piece of fine linen. Tie a strong piece of cord round the top of the pot, then suspend it from a nail, and having filled it with water, place a jug underneath, when you will possess the cheapest and most useful filter it is possible for the ingenuity of man to invent.



SECTION OF CHEAP FILTER.

INFORMATION SOUGHT.

Jumping Dial for Clock.

F. A. D. H. writes:—"Will any of our readers tell me how to convert a clock into one with a jumping dial, if possible."—[The writer had better explain what he means by a "jumping dial."—ED.]

Model of Fountain.

TROUBLESOME asks:—Can any reader of this Magazine inform me where I can purchase a small pin valve force pump, a stop-cock, and sundry small taps, etc., for a working model of a fountain?

LETTERS RECEIVED UP TO DEC. 8.

[*Replies to these in Next Part.*]

J. J. F.; ORGANIST (*Replies to queries not yet received*).

H. H. D. B.; LEX; W. H. E. (*Dartford*); F. S. (*Folkestone*); C. M. (*London, S.W.*); K. (*Kilburn*); E. E. (*Marlborough*); GEOMETRIC; A WOULD-BE MOULDER; RACAVAR; E. T. B. (*Cheltenham*).

HOW TO ADJUST A SPECIFIC GRAVITY BOTTLE.

By P. CARMODY, *of the Inland Revenue Laboratory, Somerset House.*

THERE is no part of an Analytical Chemist's apparatus in which he should take such a pride as in his specific gravity bottle. It is his *vade mecum*, and is to him what the pen is to the author or the sword to the warrior. It is, in short, indispensable; for without it his tests would be wanting in that accuracy which enables him to distinguish one liquid from another by very slight differences between the weights of equal volumes.

The price of an adjusted bottle is very much greater than that of an unadjusted one, being in the one case fifteen shillings, and in the other not more than five; and as gravity bottles, like all other glass bottles, and perhaps more than others, are liable to break, a considerable saving in the course of a year may be effected by adjusting the bottles in one's own laboratory. Moreover, it is almost impossible to take a correct weighing with a bottle adjusted by another, for the slightest variation in the pressure, or alteration of the position from the pressure at, or position in which the stopper was fixed when the bottle was adjusted, would lead to the introduction of such errors as every careful chemist should strive to avoid by all the means within his power.

Whenever, therefore, an analyst has to do very accurate work—work he can, if necessary, swear by—he is always careful to use a bottle adjusted by his own hands.

The kind of bottle which I have found answer best for general use is one holding 50 grammes, or 1000 grains (if grains are preferred), the stopper perforated by one hole only, and fitting accurately into the neck. Both the bottle and stopper must be as free from imperfections as possible. The neck of the bottle should taper gracefully. The sketch, which is given in Fig. 1, shows the outline of the bottle to which reference is made.

Let us suppose that the bottle to be adjusted is to hold 50 grammes of distilled water at a temperature of 15·5° C. (60° F.). The first operation consists in washing the bottle quite clean, using, if necessary, acids, alkali, and small shot, and finally alcohol and ether. The last washing should be with a volatile liquid, such as alcohol or ether, absolutely free from any traces of non-volatile matter. The bottle is then placed in a water oven and dried. After half an hour's drying a glass tube is inserted in the bottle, and the vapour sucked out. The drying is continued for about fifteen minutes longer, when this stage of the operation may be regarded as complete.

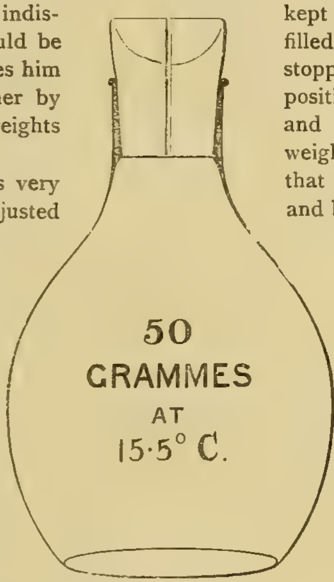


FIG. 1.—THE BOTTLE.

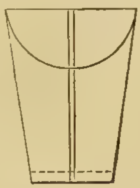


FIG. 2.—THE STOPPER.

The bottle and stopper are next taken out, and weighed separately, and the weights entered in a book kept for the purpose. The bottle is then filled with distilled water at 15·5° C., the stopper inserted gently but firmly in a certain position, which must be chosen once for all, and invariably adopted in all subsequent weighings. The position usually chosen is that in which the numbers on the stopper and bottle are in the same vertical direction.

The whole is then weighed, and if the difference between the sum of the weights of the bottle and stopper, and the weight of the bottle filled with water as directed above, be exactly 50 grammes, that part of the work is done. But it need hardly be remarked that this seldom, if ever, occurs. The error is usually very slight, rarely, if ever, being in excess of one quarter of a gramme; that is to say, the bottle may hold 50·25 grammes, or 49·75 grammes.

Case I.—The method of adjustment is necessarily different in each case. Let us first consider that in which the content is less than is required. Our correction must be with a view to enlarge the capacity of the bottle, so that it may hold 50 g. instead of 49·75 g. This is done by removing part of the lower end of the stopper—the part below the dotted line in the sketch (Fig. 2)—by rubbing on fine emery cloth. The important question to be decided is how much of the stopper must be removed? This is roughly ascertained by a short calculation. We know the weight of the stopper, we may assume for the present that the specific gravity of the glass of which the stopper is composed is about 2·5, and it is therefore obvious that the weight of glass to be removed is about two and a half times that of the water which is to take its place. Thus:

$0·25 \times 2·5 = 0·625$ grammes = the weight to be taken off the stopper.

Grind the stopper as directed until it weighs, when dry and clean, 0·625 grammes less. Again fill the

bottle with distilled water at 15·5° C., and weigh. It may now be correct, and doubtless would be if the specific gravity of the glass were exactly 2·5. But at all events we have now obtained sufficient data to determine what that specific gravity really is. Suppose the water now weighs 49·975 grammes; the stopper has lost in weight 0·625 grammes; the bottle holds 0·225 grammes of water more than before, and as the volume of water added is exactly equal to that of the glass removed, the specific gravity of the glass is $\frac{625}{225} = 2\dot{7}$.

Now multiply the error that was found in the last weighing, viz., 0·025 (=50—49·975) by 2·7=0·069 grammes=the weight which has now to be removed from the stopper.

Remove exactly this weight by rubbing on fine emery as before, refill the bottle, and weigh. The weight of water which it contains should now be 50 g., correct to within ·002 g. Clean and dry the stopper again, and take several weighings at 15·5° C. in order to make perfectly sure of the bottle's correctness.

Case II.—In this case the bottle is supposed to hold 50·25 g.—*i.e.*, one-fourth of a gramme more than is required. To correct it the stopper must evidently be pushed farther into the bottle. It is evident, too, that here no calculation can be made as to the weight which must be taken off the stopper. This is how the adjustment is done. A piece of very fine emery cloth is made to encircle that part of the stopper which fits into the neck of the bottle, and the stopper turned backwards and forwards carefully. After rubbing a little while the stopper is washed and cleaned, the bottle is filled with water, and weighed as directed above. If the water weighs more than 50 grammes, the stopper is taken out and rubbed as before with emery paper, another weighing is made, and this process repeated until the bottle holds just 50 g. of water at the standard temperature. The stopper must be rubbed down very carefully, and the weighings made at frequent intervals, as a very slight diminution in the size of the stopper causes it to sink deeper into the bottle, and so reduce its content. It should be said, however, that what happens most frequently is that too much is rubbed off the stopper, the bottle holds less than 50 g. of water, and so brings us back to Case I.

By a little experience one quickly gets into the way of hitting the right point, and what appears at first sight a difficult task, requiring much patience and manipulative skill, soon becomes very simple and easy. As regards every kind of work, whether mechanical or otherwise, practice makes the result of the operation perfect, and the assertion is no less true in this instance than in any other.

PIANOFORTE REPAIRING AT HOME.

By J. H. MOODY.

IT is our good fortune to possess a Pianoforte—maybe it is one of the newest pattern whereon the maker has lavished all improvements and embellishments tending to perfection, or, perhaps, it is not one of recent manufacture, although it is of good tone and of modern pattern; failing either of these, it may be that the instrument that we are contented to own is simply one of an earlier date, that left the maker's hands at some period in the beginning of the present century, and, of course, will not compare in any degree with his productions now-a-days. We may not obtain from it such perfect tones as we would wish to enjoy, yet if it be kept in order, the fingers of a skilful player will still elicit sweet harmonies to minister a charm to social entertainment. On the other hand, our Pianoforte, whether old or new, of ancient or modern pattern, cannot adequately give assistance to the more pleasant hours of existence, if its perfect condition be not rigidly maintained; therefore, just as a friend with a mission of importance is deserving of distinction, it is worthy of all consideration for the service that it renders, nor should be allowed under any circumstances to swell the pile of useless lumber.

To avoid the infliction of excessive charges for reparation when from any cause the instrument suffer damage or derangement, I would especially advise those with experience so disagreeable and costly to try their hand at manufacturing and replacing broken portions at home; then, provided their magnitude do not too heavily tax the home resources, repairs can be made as they become necessary, and the amateur will rise above the design or incapacity of repairers, among whom there is not always to be found a man conversant with all the parts, and a simple tuner's intelligence rarely penetrates beyond pulling up the wires.

The apparent complexity of the interior of a pianoforte justifies the caution that some readers will loudly express at the idea of repairing at home, but I think that a closer scrutiny should still the voice of dissent and overcome their objection. For the benefit of those who may be tempted to make the essay after they have solved the complication, I have recorded herein actual experience; but for the frequent use of the personal pronoun must crave indulgence, and venture to hope that useful hints for guidance may be deduced from the relation.

I would first remind the amateur that it will be necessary to combat a desire to press forward too rapidly with this work, for it is of a kind that will

demand much deliberation and care, moreover it is one wherein fascination may be especially obtrusive; therefore, I trust that he will impress this word in season upon his memory, that excessive zeal is undoubtedly responsible for the disheartenment that mistakes and failures occasion, and abandonment to its influence is most surely fatal to success.

My initiation to the mysteries of pianoforte construction dates from the time when an old-fashioned "square" came into my possession; this variety has long been superseded by the upright form, and receives scanty regard in an age that scoffs at much that is antiquated, but there was a time when, without doubt, it was accounted the perfection of boudoir instruments, and held a high place amongst household gods. Such might have been the history of the one I am writing about, and the fair preservation of the case attested that it had been treated with care, but reverent cherishment could not prevail against the ravages of time, whose impress was left in the interior, and dilapidations were evident when the lid was lifted; many wires were deficient, several dampers were wanting, and upon taking out the action, gaps at intervals along the hammer rail showed from whence hammers had fallen, in consequence of decay in the leather hinges upon which they had depended: some of these hammers were inside, but others were *non est.* Beside these defections, the one pedal (forte) with its attachment for lifting the dampers was lacking, so was the spring that supplied the pressure to oppose the action of the pedal. With the loose parts before me, I was well nigh deterred by the objections I have before noticed, but the fact that the instrument was of no use in that condition decided me, and I made the plunge on the speculative principle. Before drawing out the action I was compelled to lift out the name-board and several of the keys at either end in order to draw the screws that held the key-frame to the bottom of the piano; when that was done the key-frame, having some of the action attached, came out with a little persuasion (see Fig. 1), leaving the way clear for restringing.

I did not know where to get material for this until, taking with me by way of pattern a piece of each string that I intended to renew, my quest revealed the fact that at the warehouse of Messrs. Hughes, Music Smiths, in *Drury Lane*, every requisite could be obtained, and I was there supplied for a trifling sum with an abundance of steel wire proper for my purpose; thus was I fairly launched, and went to work in my own fashion with a method which perhaps would not strictly accord with professional ideas; nevertheless, by proceeding with caution I was enabled to review my labour at intervals, and remedy blunders or retrieve false steps.

I began by measuring the strings to be renewed, allowing additional length required in making the eye and for winding round the wrest-pin, then I cut my wire and reduced to pliancy the intractibility of the steel by passing each end through a candle flame just sufficiently to draw the temper. This preparation of the wires brought the difficulty of making an eye to each one to be surmounted, and taking one I bent over one end to about one inch, and screwed the loop in a hand-vice, then a couple of twists with a short piece of $\frac{3}{16}$ inch round iron inserted in this loop formed the eye which had to be finished by carefully twisting and by cutting off the end to leave $\frac{1}{8}$ inch sticking out at right angles to prevent running back under strain (see Fig. 2).

To put the completed strings in their places a few backward turns of the key enabled me to draw out each of the wrest-pins, and having cleared them of old wire, I found in some a small hole that saved a deal of trouble, and gave greater security in winding on the new wire; others, however, were not so provided, and I was driven to use the expedient of laying about three-quarters of an inch of wire along the pin and binding tightly over that. In either case, I had to consider that the tuning-key is turned from left to right, therefore the wire had to be wound in the opposite direction, and the lower part of the pin held during the process. I also found that dusting the wrest-pin with a trifle of powdered resin before replacing was a good plan, and one that would counteract any tendency to yield that the pin might manifest when strain was applied. The secure and firm placing of the eye upon the hitch-pin and the correct laying of the wire between the pins provided for it upon the bridges constituted my next care, and completed the task of restringing, with the exception of tuning the new strings to accord in some slight degree with their neighbours.

I now felt that I had reason to congratulate myself on the successful progress of my work, and I turned my attention while yet the piano was clear, to the dampers and the parts pertaining to them; these consisted of a set of levers hinged to a slip of wood by pieces of leather, and placed rather inaccessibly at the back of the interior, a series of buttons hinged by leather to the levers, and screwed into these buttons were tapped wires carrying the dampers. The orderly arrangement of all these parts demanded regluing of levers that had parted from their rail, also of buttons that were detached from levers, and I procured Cologne glue, which is nearly colourless, and is of great adhesive quality, for this purpose. Where hinges were too far decayed to use again, I employed new ones made from pieces of rough calf leather stripped from the cover of an old account

book, and lost dampers I replaced by new ones that I made from sycamore (Fig. 3); a piece of this wood that I procured for a shilling in *Curtain Road, Shoreditch*, was much more than I then required, but I have since found my store very useful, and its bulk is now somewhat reduced. I paid sixpence per set of sixty for tapped wires at Messrs. Hughes.

The damper lifts standing up between the wires were kept within proper limits by a slip of wood let into the wrest plank bridge. This "Register Rail" was notched to allow space for the hammer stroke, and was provided with a row of holes bored at regular intervals and clothed to ensure silent action; the guidance, however, that this afforded was ineffectual until some defective damper lifts making an unpleasant jarring by interfering with a vibrating string were set straight.

The dampers were now perfect in their action, each one being raised from the wires simultaneously with the blow from the hammer by the key-tail lifting the lever, they were also precise in performing the office for which they were intended, the tapped wires allowing of their accurate adjustment; but seeing that the exigencies of music do not require that their deadening influence be constantly exercised, a contrivance had now to be thought out for employing the foot to raise the whole of them, and produce the variety of prolonged sound; to this end I fixed by hinges to the lever rail a slip of pine of the same length and $\frac{3}{4}$ inch in thickness. There was already completely through the floor of the piano, and immediately under the centre of this rail, a circular hole, in which I fitted a cylindrical block of deal with a felt pad upon its upper end, and a piece of very stout brass wire screwed into its lower end. Where this aperture came through to the bottom of the piano, was fixed an extra leg which was pierced with a slot 3 inches long by $\frac{3}{4}$ inch, or rather more wide, and bored vertically from the top end down to the slot. I accordingly made a pedal "shoe" of 1 inch mahogany, and a lever or "rocker" of $\frac{3}{4}$ inch beech; the pedal shoe I hinged to the lower end of the leg, the rocker I fixed to work from the bottom of the piano. When the leg was properly screwed into the socket provided for it, the pin in the cylindrical block came down through the vertical bore and about three-quarters of an inch into the slot, and one arm of the lever was in the slot ready

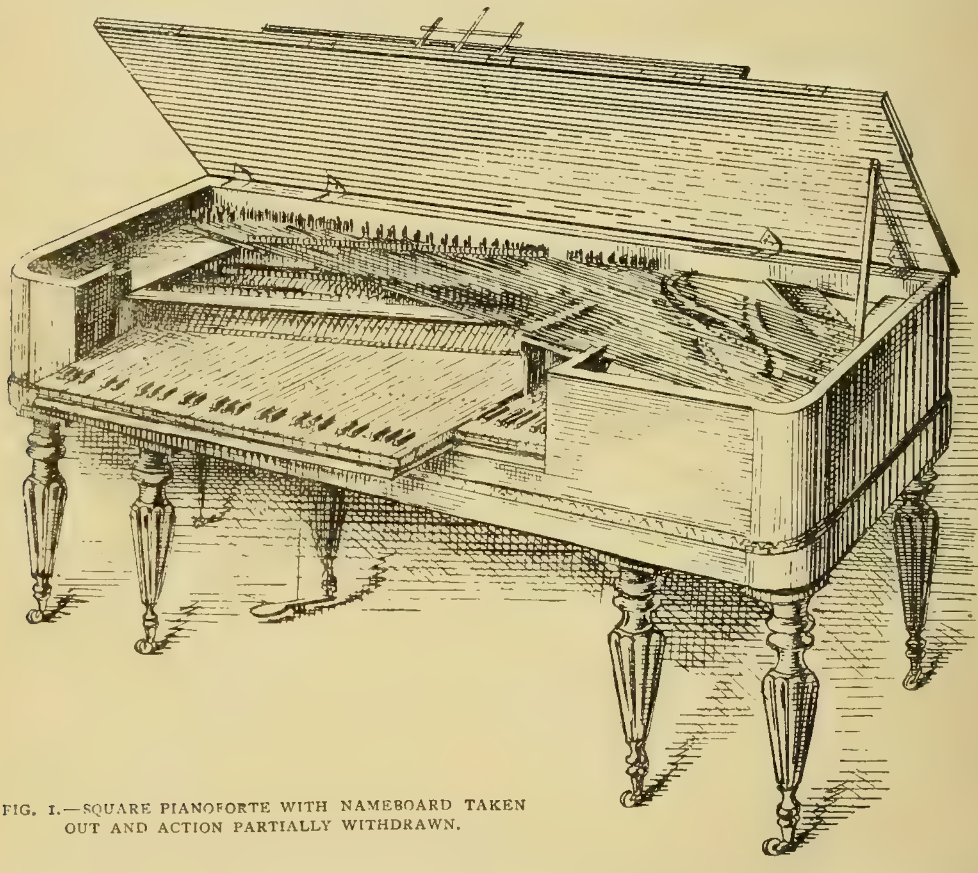


FIG. 1.—SQUARE PIANOFORTE WITH NAMEBOARD TAKEN OUT AND ACTION PARTIALLY WITHDRAWN.

to push up the pin with block when the other arm was pulled down. To form the connection between rocker and pedal shoe I took a very stout brass wire tapped at either end, using nuts made from beech to fasten it, and felt washers to intervene between wood and wood. An action spring costing twopence was fixed to press upon one end of the lifting rail, keeping it down, and opposing the pressure communicated by the pedal (see Fig. 4). At this stage I must not omit to mention that, to ensure silent operation of all parts, I employed black lead as a lubricant wherever friction of two surfaces would be likely to assert itself in a discordant manner.

The space at disposal in a square piano is so limited that transverse stringing is adopted to admit even a moderate compass of notes; the hammer rail is consequently fixed across the keyboard at an angle in order that each hammer may have the fullest allotment of elbow-room, yet may strike its proper wires with as wide a surface as possible. The stems of the hammers vary in length, those in the centre being longer than those at the ends; and in the face of this variation it would be a matter of difficulty and of no practical value to give the size of any one part.

The action that I withdrew at the outset of my task were the keys with hoppers mortised to them, also hammers and hammer levers hinged respectively upon rails that were supported upon standards fixed to the ends of the key-frame. Of these parts the hammers stood most in need of repair, and I made new ones in mahogany to replace those that were lost, my pattern being one of the old ones that had fallen off the rail; imitating this (see Fig. 5), I shaped the stems in thin wood, and upon each I glued a head and a piece of the same thin wood, first having filed a lap in the latter of just sufficient depth for a part of

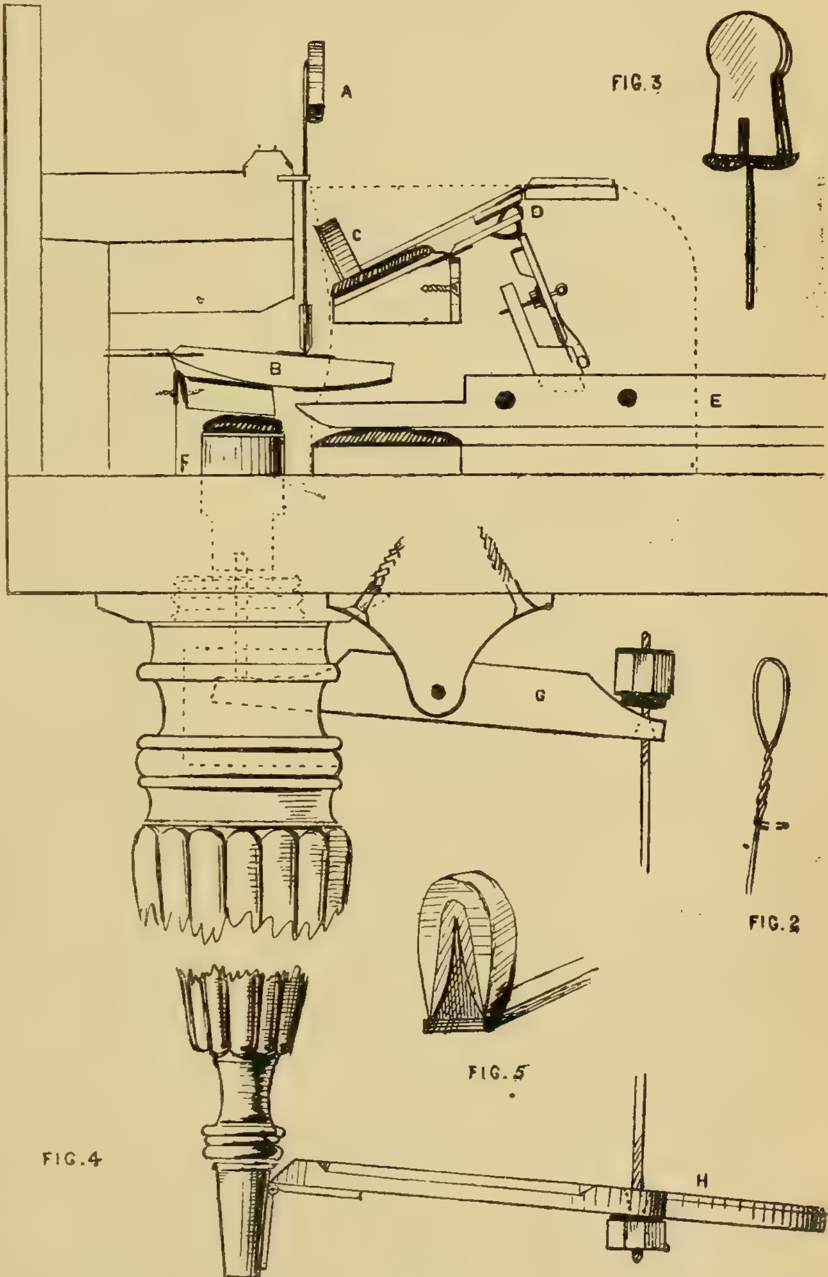


FIG. 2.—EYE FOR STRINGING. FIG. 3.—DAMPER. FIG. 4.—SECTION OF PEDALLING—A, Damper; B, Damper Lever; C, Hammer; D, Hammer Lever; E, Key; F, Damper Rail; H, Pedal. FIG. 5.—HAMMER.

the leather hinge, to be also glued, to fit closely into. I then clamped each one tightly until it was dry, and meanwhile put new hinges to those that required renovation, first removing old leather from the slots by the aid of a thin-bladed knife.

In this way I made up the complement of hammers; but before I covered the new ones, or filled up the gaps upon the rail, the idea struck me that the piano would be considerably improved if they were all taken off and recovered with modern felt, as the original covering of leather was become so very hard and compact. I therefore took off the rail all those that remained intact, using a warm iron to destroy the old glue; and I employed the same method to facilitate the removal of the old coverings. I then bought from Messrs. Godard, *Tottenham Court Road*, a set of taper felt for 1s. 9d., a low quality, but quite thick enough for the job. This I cut in strips rather wider than the hammers, taking the precaution as I went along to put both hammers and strips in order of sequence, a necessary precaution, as the felt varies in thickness from end to end: hence its name; and, as I have mentioned, the hammer stems were not identical in length. Taking each strip in succession, I trimmed it thinner at the ends, and applied thick glue, leaving about half an inch in the centre untouched; then I drew it across the hammer head tightly and bound with tape to keep it in that position. The tone of a piano proportionately suffers, as the felt fails to fit closely to the nose of the hammer; therefore, this binding must be done with care, and should by any chance a laxity occur during the operation, the new felt must be stripped from each faulty one and the process of recovering repeated. When all the hammers were dry I finished them by trimming the felt with a sharp knife close up to the hammer-head, smoothing ragged edges with a hot iron, and proceeded to fasten each one in its old place upon the rail. This being achieved in a satisfactory manner, I replaced a slip of mahogany, which I had forgotten to mention was screwed over the leather hinges to hold them firmly and give the top of the hammer rail a neater appearance.

It will be seen that the drawing, Fig. 1, shows the withdrawal of only a part of the keyboard, this portion is divided from the other by a support to the soundboard resting on the floor of the piano. The dampers do not extend beyond the compass of the larger of these two portions, and it is scarcely necessary to say that my remarks regarding repairs are applicable to the smaller frame which contains but a few of the keys.

Being now anxious to try the effect of my work that had progressed so nearly to completion, I overhauled the keys and renewed the baizes upon the back, centre, and front rails of the key-frame; then I replaced the keyboard and hammers to try the touch, and equalization was effected as their defection demanded, by slipping discs of paper under the keys, and on the pins, either upon the front or centre rails, accordingly as the touch was too deep or not deep enough. To prevent hammers blocking I regulated their due falling off from the wires by turning out the small screws in the hoppers.

My labours to rescue the piano from disuse, though limited, were effectual. The condition of the instrument might not have afforded satisfaction to the advanced student in the art of music, but being of a very easy touch it served a good purpose, and proved a convenient means for the children to rehearse their exercises upon without causing such a degree of fatigue that a newer instrument with a harder touch will occasion. A better result could not have been obtained by doing more than I did, and it would have been of no avail to expend more time and trouble upon a piano so much out of date.

THE MAGIC LANTERN:

HOW TO MAKE IT AND USE IT.

By A PRACTISED HAND.

III.—How To Use The Lamp—The Slide-Holder—The Screen—The Screen Stand—Dissolving Views—The Lantern Box—The Lime-light.

WHEN you want to use your lantern, you should warm and carefully wipe the lenses of the condenser and objective; put the former into the holder in the front of the lantern, screw the latter into the ring in the front tube, and slide the slide-stage into the grooves on the lantern front, pushing it "home." Then open your lamp, and put a piece of 1½ inch lamp wick into each holder, cut the edge of each wick perfectly straight and even, see that they work freely up and down in the holders, and partly fill the reservoir with the best paraffin. You should use only the *best* paraffin, and never fill the reservoir more than two-thirds. As soon as the wicks are thoroughly soaked, light them, turn them down low, and close the lamp. Draw out the chimney to its full length and put it on, then slide the lamp in the grooves in the bottom of the lantern, and begin turning up the wicks; they must be turned up equally, and little by little, so as to heat the front glass gradually. If they are turned up suddenly the glass is very likely to break, and, what would be far worse, you might crack the inner lens of your condenser. After a minute or two, however, you can safely turn them up to their full height. The maximum light is obtained

by turning them up until they are on the point of smoking. It is a good plan to turn them up until they begin to smoke, then turn them down very gradually until they cease to smoke. The smoke is seen issuing from the top of the chimney.

Stand the lantern on a high steady table, and turn it towards a white wall if you have one; if not, you must hang up a sheet or tablecloth to form a screen, taking care to hang it so as to avoid all folds or creases which would cause unsightly shadows in the picture and distort it. Now focus the disc by turning the focussing screw on the objective lens, and when the edge of the disc is quite sharp and equally illuminated in every part, you can put in your slide-holder and the slides you intend to show one after another. If a shadow appears on the upper or lower half of the disc, it is probably owing to the lamp having been pushed into the lantern a little too far or not far enough, and, of course, you get rid of the shadow by moving the lamp one way or the other. Sometimes, however, the mark is due to damp on the condenser, in this case it will fade away in a few minutes when the condenser gets dry.

If our lantern works satisfactorily, we can next turn our attention to the principal accessories.

The first and most indispensable of these is

The Slide-Holder or carrier mentioned above. A good many different carriers have been used, most of which answer their purpose well enough. The one I am about to describe has the advantage over many others of being easily made, light, and handy. The object of the carrier is not merely to hold the slides (as many people suppose), but also to enable you to put them exactly in the right position in the slide stage. Without a good carrier one slide might be pushed in too far, another not far enough; and, in fact, every slide would have to be adjusted in the lantern, which, besides being a great waste of time, is most disagreeable to the spectators. When dissolving-views are shown, half the effect is lost if the slides do not appear exactly in the right position on the screen.

Fig. 21 shows the carrier for the ordinary $3\frac{1}{4}$ inches by $3\frac{1}{4}$ inches slides. It is $9\frac{3}{4}$ inches long by $4\frac{1}{4}$ inches wide, and the aperture of the frame is $2\frac{7}{8}$ inches square. It is made of mahogany or other hard wood, of which you must cut out six pieces, two for the top and bottom and four for the sides. The former are $\frac{1}{2}$ inch thick and $\frac{11}{16}$ inch wide, the latter are thin strips about $\frac{1}{8}$ inch thick and 1 inch wide. As shown in the figure the four side-pieces are let into the top and bottom pieces, so as to leave an aperture between them for the admission of the slides. The top and bottom pieces are grooved to a depth of somewhat over $\frac{3}{16}$ inch, the width of the groove corresponding to the width of the opening between the side-pieces, or about $\frac{1}{4}$ inch. Of course the two grooves must be quite smooth for the slides to run in. The carrier is inserted in the slide-stage and kept in its place by the spring-plate, the slides are then pushed into the carrier on the right-hand side and withdrawn on the left. You begin by putting the first slide into the grooves, then you push it into its exact position in the frame by means of the second slide which you push in after it until its outer side is in a line with the ends of the holder, then when you want to show the second slide you put the third into the grooves and push the second into the place of the first, which is pushed to the other end of the holder, where it can easily be removed. Thus your slides will always be exactly centred, and each one ought to be in focus after you have focussed the first.

When you first put the carrier into the stage aperture, you will have to see that you get the frame in the centre of the lens tubes, but if you then make a mark on it, or nail a little bit of wood to the bottom to form a stop, you will have no difficulty in putting it back again in the right place on a future occasion. I may as well mention here that the slides must be put into the carrier *upside down*, and the black side of the mount is generally turned outwards, but this, of course, depends upon how the slides are mounted. Sometimes plain black mounts are used, in which case it is not very easy to tell which is the right or film side of the picture or photograph, and the slide is very likely to be put in wrong, which, though not always of much consequence, would in certain cases be very inconvenient, as, for instance, if a map of the United Kingdom were shown in reversed order, *i.e.*, with Ireland on the right or east side of England.

The Screen must next claim our attention. There are transparent screens and opaque screens. When a transparent screen is used, the lantern is placed behind it, and the pictures are shown through. It is generally much more convenient to have the lantern away from the spectators, and the effect of the sudden appearance of the pictures on the screen is more startling when the lantern is not seen. But there are two disadvantages attending the use of transparent screens—one is the amount of space that is lost behind the screen, which, if the room in which the entertainment is given is small, is a matter of no little importance; the other is the glare that is always seen more or less in the centre of the disc, and though it is reduced to a minimum by wetting the screen, yet it cannot be altogether got rid of. Again, the necessity of wetting the screen is another drawback, especially if it is to be hung up in a drawing-room. In addition to these disadvantages there remains the fact that the pictures are never quite so clear when shown through a screen as when shown on an opaque surface.

A transparent screen can be made of muslin; but it is better to make it of thin cotton sheeting or some semi-transparent material, because it can then be used as an opaque screen should the necessity for doing so arise. If the exhibitor is satisfied with a small screen, say 9 or 10 feet square, he can get some cotton sheeting of that width, but if he wants a larger screen he will have to join two or more widths. The seam ought to be as narrow and as neat as possible, and should be in the lower part of the screen, which, unless it is very large, can easily be managed. A broad tape should be sewn round the edge of the screen in which eyelet-holes can be worked. These eyelet-holes are for stretching it to the stand, to be presently described.

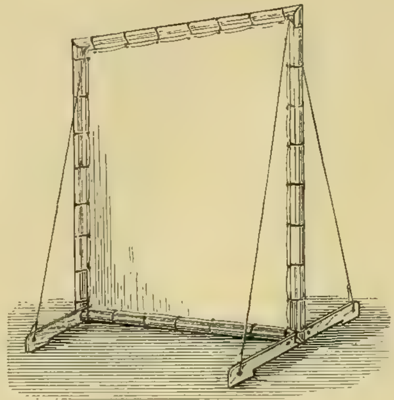


FIG. 22.—SIMPLE SCREEN STAND.

Nothing makes so good an opaque screen as a plain white wall, but, unfortunately, now-a-days, this is very seldom available. A very good screen can be made by pasting large sheets of white paper on to fine canvas or linen. When quite dry, it can be mounted on a roller of suitable size. Of course, a screen of this sort might be made of almost any size, but it would be very awkward to carry about if more than 10 or 12 feet square, and it cannot be folded up. It shows off the pictures very well, however, is always ready for use, and is put up without a frame. It has this great advantage over linen and cotton screens, that a slight current of air does not affect it, whereas the latter are swayed by the slightest draught. It is a good plan to make a 10-feet paper screen for use in ordinary rooms, and to have besides a 15-feet linen screen for use as a transparent or opaque screen in schoolrooms or other places where a large screen can be put up. Screens of 20 feet, 25 feet, and even 30 feet, are used by professional lecturers, but the amateur is not likely to require one more than 15 feet, or at the most 18 feet square. Nor is it at all advisable to show the pictures on too large a scale. Small bright pictures are always more pleasing and effective than large dull ones. The size of the pictures depends upon the distance the lantern is from the screen; and we should not forget that "light decreases inversely as the square of the distance." Slides vary so much that it is impossible to say to what extent they should be magnified. Some look bright even when shown on a large scale, whereas others look dull and heavy on quite a small screen. In choosing slides, the preference should always be given to those which appear to be the most transparent when looked at through the light.

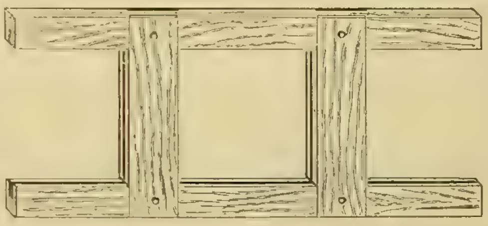


FIG. 21.—THE SLIDE-HOLDER OR CARRIER.

The Screen Stand is a very useful accessory. Indeed, it is almost indispensable if a large screen is to be put up in a room where it would be inconvenient to drive nails into the walls. A good screen stand not only supports the screen, but keeps it stretched and steady. Fig. 22 shows a simple but very efficient stand which the amateur will find no difficulty in making. It can be used for screens of different sizes, and is as portable as a stand could be. It consists of two wooden feet, Fig. 23, each about 4 feet long; two metal bends, A, Fig. 24; two corner-pieces, Fig. 25, also of metal; and a number of ash poles, B, Fig. 24, about 1 inch in diameter. A tube is fitted to one end of each of these poles, so that three or four of them may be joined together end to end as in a fishing-rod. We ought to have twenty poles 3 feet long, and four poles 4 feet long. This will enable us to use the stand with screens of 7, 9, 10, 12, 15, and 19 feet square. Supposing we want to put up a 12 feet screen, we use sixteen of the 3 feet poles, four at top, four at bottom, and four on either side. Of these sixteen poles, four must be without connecting tubes, as the metal bends which are fixed in the feet with thumb-screws and the two corner-pieces, take the place of four connecting tubes. The screen must be tied at intervals of about 9 inches to the series of poles, which will form the top of the frame, then the corner-pieces which are made of two 1 inch tubes joined together at right angles with a cross-piece to straighten them are put on to the end poles, and one of the remaining poles is put into the other tube of the connecting pieces, the screen tied to it, and then a second pole joined to the first, and so on. Two cords, C, D, Fig. 24, are brought down from the two corner-pieces, and when the frame is complete and the end poles have been inserted in the metal bends, they are tied to the two extremities of the feet to keep the stand steady. The four poles for the bottom serve to keep the feet apart and thus stretch the screen; it is, of course, tied to them (with

strings let into the eyelet-holes along the edge of the screen or with tapes sewn on to it). For a 15 feet screen we would require twenty 3 feet poles, or if we prefer to use longer poles, twelve of 5 feet. A stand of this sort could also be used as a frame from which to hang the paper screen, and as it requires no support it can be put up in any part of the room.

Dissolving Views must next engage our attention. This very pleasing effect was first shown by Mr. Childe in the early part of this century. It is produced by means of two lanterns. A sort of metal comb is moved in front of the lanterns in such a way made in a variety of shapes, and sometimes moves horizontally and sometimes vertically, but the principle on which it works is always the same.

Fig. 26 shows a dissolver well adapted to our apparatus. It might be cut out of stiff cardboard or a thin bit of wood, and blackened on both sides; but it is better to cut it out of tin, and japan it. You can cut it out of one piece as shown in the figure; but it is more handy if made in three pieces (a centre-piece, A, Fig. 27, and two flaps, B). In either case it must be 11 inches in extreme length from the points of the combs or teeth, and $7\frac{1}{2}$ inches in height. The width

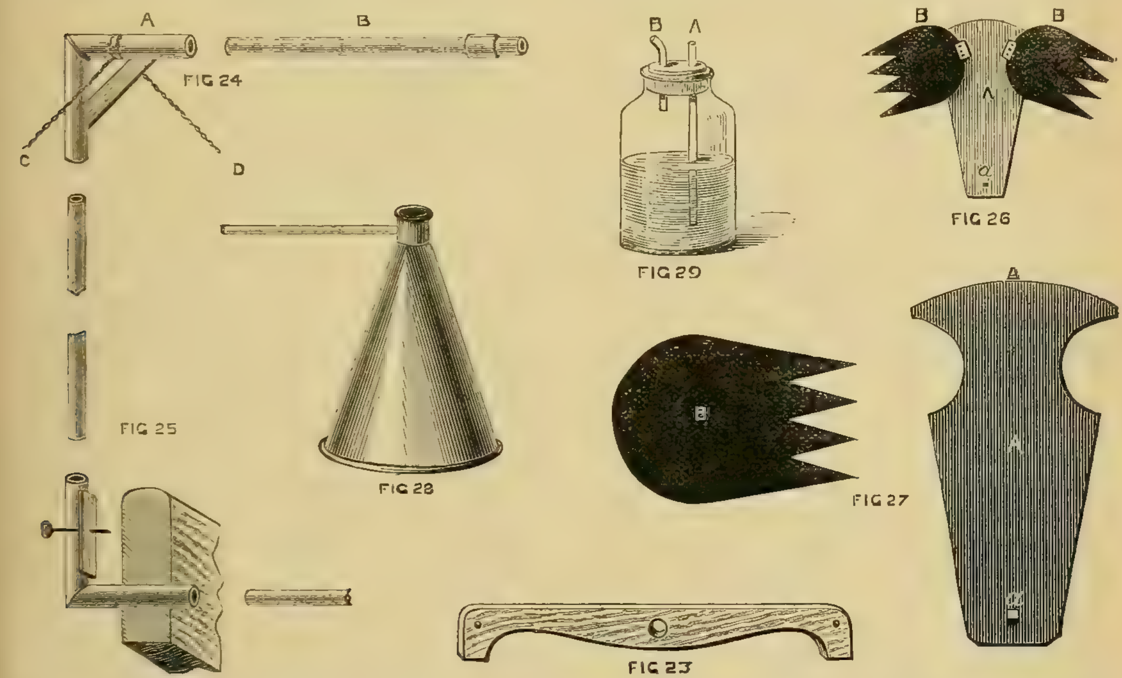


FIG. 23.—WOODEN FEET FOR SCREEN STAND. FIG. 24.—METAL BENDS OR ANGLE PIECES FOR FRAME. FIG. 25.—ANGLE PIECES ENTERING FEET OF STAND. FIG. 26.—DISSOLVER FOR DISSOLVING VIEWS. FIG. 27.—PARTS OF DISSOLVER, VIZ., (A) CENTRE-PIECE, AND (B) SIDE-PIECES. FIG. 28.—IRON RETORT FOR MAKING OXYGEN. FIG. 29.—PURIFIER.

as gradually to shut off the light from one, while that from the other is as gradually admitted to the screen. Before we can give a dissolving view entertainment, therefore, we must provide ourselves with a second lantern similar to the one before described. It must have a condenser of the same size, an objective of the same focus, and a lamp of equal illuminating power. The two lanterns are placed side by side, but must be turned *slightly* towards each other, so that the two discs on the screen may exactly coincide or overlap. A slide must be put into each lantern and focussed, the light meanwhile being shut off from the other lantern. A separate slide-holder must, of course, be used for each lantern. The dissolver is

of the arms or flaps is $3\frac{1}{2}$ inches, and the length of the teeth $1\frac{3}{8}$ inches. When it is made in three pieces, the two flaps are hinged on to the centre-piece, the advantage of which arrangement is that a disc from both lanterns can at any time be projected on to the screen by merely putting the dissolver midway between the nozzles of the objectives and turning out the flaps. The light from both lanterns can then pass freely to the screen.

The dissolver is fastened to a brass or wooden rod about a foot long, and, say, $\frac{1}{2}$ an inch in diameter. One end of the rod is squared to fit into the hole, A, of the dissolver which is kept in position by a metal washer and a thumbscrew, screwing into the end of

the rod. A stand for the rod can be made of a piece of wood about 10 inches long and 2 inches wide, and ½ inch thick. This piece of wood should have a couple of thumbscrews for fixing it to the box or table, on which the lanterns are placed. Two brass screw rings of suitable size screwed into the stand near each end, will form simple but efficient holders for the rod. It should, of course, turn somewhat stiffly in them, so that the dissolver may remain in the position you wish. A couple of nails or plugs should be driven into the rod to catch against the stand when the dissolver is fully off either lantern, this prevents you turning the dissolver too far in either direction. The exact position of the plugs or stops must be found out by trial. A small wooden handle terminating in a screw is used for turning the dissolver; it screws nto the under part of the rod, and hangs down in front of the lanterns, or rather between them.

The proper position for the dissolver is about 1 inch in front of the objectives when correctly focussed. Supposing we now put a slide into the carrier in the right hand lantern, then, as soon as we are ready to begin dissolving, we slowly move the handle to the right and continue to move it without jerking it, until we see that the points of the comb are off the lantern, or until the catch stops us. We must then change the slide in the left hand lantern, and when it is to be shown, move the handle towards the left, as gradually as before, until the second catch stops us, and so on, alternately moving the handle towards the lantern we wish to bring "on the screen."

As the lanterns should never be left lying about with the lenses exposed to dust and damp when not in use,

The Lantern Box will be found a very useful accessory. It can easily be made by the amateur carpenter out of any well-seasoned ½ inch boards. The dimensions of a box to hold two lanterns, or double box, as it might be called, are 19½ inches by 15½ inches by 5½ inches (inside measurement). A shelf divides the box into two compartments, each just large enough to hold a lantern with its lamp, the chimney, the dissolver, a paraffin measure, and some rag, etc. The box opens at the end, and the lanterns are generally slipped in back foremost. Turned on its side the box forms a stand for the lanterns, and the dissolving apparatus can be fixed to it with a couple of thumbscrews. It can also be used for putting the slides in during the entertainment. A simple handle that does not get in the way can be made by screwing a strip of stout leather to the top. For a single lantern, the box should be 15½ × 9½ × 5½ inches.

A flat tin bottle forming a measure and a funnel are useful for filling the reservoir. If the former is made 4½ inches high by 2¾ inches by 1⅜ inch, it will hold sufficient paraffin for an evening's entertainment, and will pack inside the chimney; the funnel may also be made of tin, and if it is made oblong and of the same dimensions as the top of the bottle, it will fit on it when not required.

Although the lamp we are supposed to have used hitherto will do well enough in small rooms, and is very handy and easy to manipulate, yet, if we wish to show our slides on a large screen, we must have recourse to a much more powerful light. Such a light is

The Lime-Light, which, taking it all in all, is the best light for the lantern. It was introduced more than half a century ago, and was first called the Drummond light. It is produced by blowing a fine stream of oxygen through a flame of spirits of wine or hydrogen on to a disc or cylinder of lime. The part of the lime exposed to the action of the oxygen immediately becomes white hot and so incandescent as to be almost painful to the unprotected eye.

When the light is produced with spirits of wine and oxygen it is called the oxy-calcium light, to distinguish it from the light produced by means of oxygen and hydrogen, which is called the oxy-hydrogen lime-light. The former is less powerful than the latter, but as it is the more easily produced of the two, I will describe it first. The apparatus required are the following: a burner (or oxy-calcium jet, as it is generally called) to fit inside the lantern; two lengths of india-rubber tubing, one about 4 feet long and the other about 2 feet; a retort large enough to hold some two or three pounds of the chlorate of potash and manganese mixture from which the oxygen is obtained; a purifier for freeing the gas from impurities and cooling it; an air-tight bag or other receptacle in which to collect it; a pair of pressure boards for forcing it out of the bag when required; two or three weights (say one of a quarter of a cwt., and two of 14 lbs. each); and a lime cylinder.

If the amateur lanternist has a laboratory, he will be sure to have a retort, which, of course, he can use for making oxygen. If not, he will have to buy either a copper or an iron one. An iron retort of the form shown in Fig. 28 costs about half a guinea, a copper one would cost about half as much again. The former is generally made of sheet iron brazed together. It has a brass screw top, into which is fitted a piece of iron piping about a foot long. An india-rubber tube connects this pipe with the purifier. This retort can be heated either on a Bunsen's burner or on a clear fire. The Bunsen's burner is preferable to the fire, as the heat can then be increased or diminished so as to regulate the flow of the gas.

The purifier can be made out of a wide-mouthed glass bottle or jar, as shown in Fig. 29. The two tubes, A and B, pass air-tight through a plug or cork,

the former tube must be of a length to reach to within about ¾ inch of the bottom of the bottle, the latter, which is for the exit of the cooled and purified gas, is only 3 or 4 inches long. When required for use the bottle is about two-thirds filled with cold water. A zinc box with two tubes soldered, or, what is better, made to screw into the top of it forms an excellent purifier. The tubes should be rather larger than the india-rubber piping, so that the latter on being sprung over the ends may fit tightly to them.

The jet itself will be described, and the mode of using it explained, in the next paper.

(*To be continued.*)

MY MARIONNETTE THEATRE:

HOW I MADE IT AND WORKED IT.

By EDWARD A. LEONARD.

II.—The Figures: How to Make Them—Mounting and Working Figures—The Beast—The Dragon—Cost of Theatre, etc.

4. THE FIGURES.—I found some difficulty in getting dolls with physiognomies suitable for representing various characters, the ordinary type of countenance to be met with in the dolls of the toy shops not presenting much variety, and when one wanted a whiskered prince, or a villain, or an elderly man or woman, or anything in fact, except a smiling pink-cheeked young lady, considerable difficulty arose. Not living in London, I wrote to Mr. Whiteley, the World's Provider, to enquire whether he could supply the sort of article required, and was informed in reply that certain Marionnette figures, which were specified (I cannot quite remember what they were, but I think one was a dancing sailor), could be supplied at prices ranging from one guinea to two guineas each. This not suiting my purpose at all, I soon found necessity to be the mother of invention, or, if not invention, of adaptation, and that by a little contrivance the resources available could be successfully turned to account. A little wax pinched on to the snub nose of a smirking doll, and a few strokes of a paint brush soon gave the requisite expression of malignity for the "proud sister"; whilst by cutting the hair of another young lady, and affixing a portion of it to the upper lip, a handsome prince resulted. Grotesque heads may sometimes be obtained and placed on suitable bodies. I made a most benignant and venerable old man by fixing a flowing white wig and beard to a head that had originally done duty as a Punch, and was fortunate in meeting with some other grotesque heads (intended for use in a sort of Punch and Judy show in which the operators' hands supplied the place of bodies), which were soon affixed to suitable bodies, and appropriately dressed for the characters required. The best bodies are those covered with white kid. They are strong, and more shapely than the commoner sort. It may be necessary to loosen their joints a little, especially at the shoulders and elbows.

The figures are supported and worked in the following manner:—A small eye is sewn firmly to each shoulder, and the figure is suspended by a couple of fine wires fastened to these eyes and terminating at the top in small brass rings, through which is passed a brass (stair-carpet) rod 26 inches in length. Another pair of fine wires is fastened to the figure's hands and attached above to the same rings. Sometimes it may be found well to cross these hand wires, *i.e*, to carry the wire from the figure's right hand to the ring from which the *left* shoulder is suspended.

The wire used should be iron, and, of course, the finer it is the better, so long as it is strong enough to support the weight of the figures. It should not be bright (like that used by florists), but dull. If care is taken to avoid kinks, a very fine wire will bear considerable strain without snapping. What I use is known as 36 W.G. black annealed iron wire. The wires attached to the figure must be of such a length as that, when the brass rod lies across the rest-bar and back horizontal, the feet just touch the stage, and the hands are in a natural position. By sliding the rod about, the figure is made to advance or retire whilst by means of the wires attached to the hands, the arms can be moved in various ways.

Two persons are needed to work the figures, who must stand upon a strong table of about equal height with the stage table, and placed immediately behind it. They are assisted by two others who stand on the ground or platform, one on each side of the stage. The figures are introduced upon the stage between the two side uprights, care being taken that the brass rod supporting them rests on the framework above, so that the figure's feet are not off the ground.

Fairies, witches, and such like supernatural beings may descend upon the stage from above. It will be the duty of the helpers at the side to hand the figure at the right time to those who stand upon the table.

When the figures have to lie down, kneel, etc., it will be found convenient to slip the brass rings off the rod, and on to a slender, but sufficiently strong wire pot-hook (from 4 inches to 6 inches long), and this, if the operator's hands are full, may be temporarily hung on to one of the horizontals, until the figure has to be raised again.

For speaking or reading the various parts, different voices will, of course, be needed, though one person,

by changing the voice somewhat, may do the talking for two or more characters, especially if they do not happen to act in the same scene. Several rehearsals will be necessary, it being specially needful that those who work the figures should know the play well so as to be able to "suit the action to the word." If they can learn and say some of the parts so much the better. The figure, who is supposed to be speaking, will turn to the one whom it is addressing, move the hands, etc., and so attract the attention of the audience.

The entrances and exits in the different scenes will have to be arranged with some care. Rehearsal will soon show on which side it will be most convenient for each to be made, and when this has been determined, the books should be marked accordingly, and the same arrangement always adhered to.

Experience will also show the advantage of a systematic division of labour among the helpers behind the scenes. It might well be made the exclusive work of one person at the back to get the figures ready as they are required, and hand them to the helper on the side by which they are to enter, receiving them similarly on their exit.

When the figures are not on the stage they should not be taken off their brass rods, lest the wires become entangled. Two small towel-horses of equal height (not less than 36 inches) placed side by side, about 20 inches apart, form a convenient rest for them. It is worth while to have a small pair simply made in deal. They need have no feet, but can be kept in position by transverse rails being fitted into holes in their upright ends, removable, of course, for portability.

In packing the dolls, too, care must be taken not to entangle the wires, which should be coiled into a ring and tied with a bit of twisted tissue paper or string. They may be placed pretty close together in a strong cardboard box, or one made of thin wood, covered with American cloth and furnished with a tray, so as to hold a dozen or more, the whole "company," in fact.

The first play we produced was "Beauty and the Beast," one of Miss Corner's "Fairy Plays for Home Performance" (published by Dean and Co.) The second, "The Sleeping Beauty," by the same authoress. It will not be necessary to describe them in detail, but it may be useful to mention how some of the more striking effects were produced.

The Beast was a brown flock-covered bear procured at a toy shop; it had a small wheel, unobservable, in each of its feet, so that it could be easily drawn about the stage by a pair of wires from above; its head wagged and swayed from side to side, and its whole aspect was appropriately melancholy. In the last scene, when he is discovered dying under a rose tree, with Beauty kneeling by his side, and when he is transformed into a Prince, the original Beast is represented by a flat cardboard model, painted to look as much like the bear as possible, only in a lying posture, the illusion being aided by the light being quite low; the Prince, also in a lying posture, concealed behind the Beast and the bush, the whole group being arranged at the side of the stage. At the right moment the cardboard model being pulled by a black thread falls flat on the stage, and is drawn away under the side curtain, the Prince being raised at the same instant, and the lights turned up. The device sounds somewhat lame, but it really worked very well.

The transformation of the old Beggar Woman into the Fairy was effected by enveloping the latter in a sort of hooded waterproof cloak, long, overlapping in front, but not fastened, which could be dexterously whisked off upwards by a thread. When

FIG. 5.—THE DRAGON.

thus disguised, care was taken to avoid turning the face towards the audience.

In the supper scene a pretty effect was obtained by having the table laid out with miniature cups and dishes, cakes, flowers, candlesticks with coloured tapers, etc., and the appearance of the fairies was always accompanied by appropriate strains from a large musical box.

It is a slight disadvantage in this play that the scenes are so short and numerous. Changing the scenes always involves a certain amount of delay, which may become a little tiresome to the audience, especially if the same scenes recur two or three times in the course of the play. Of course, this objection may to some extent be lessened by judicious rearrangement; but a piece with fewer, longer scenes, each different from the preceding, is certainly to be preferred. Such a one was Miss Corner's "Sleeping Beauty," which proved a great success.

We found it necessary to reduce the number of the characters by dispensing with the services of the Nurse (a cradle being substituted), and of the Gentlemen of the Court, and, by omitting Scene 4 in Act

III. (with the exception of the final speech, which was placed at the end of Scene 3) the second King and Queen were not wanted.

The remaining characters afforded abundant variety and amusement. Some of them have already been alluded to at the beginning of the paper, and they need not be further described. The "Dragon Scene," however, was so eminently successful that I must give some account of it, in conclusion.

And, first, I must attempt to describe the Dragon himself, although really he should be seen to be appreciated. It really was sometimes quite curious to observe the awe-inspiring effect produced on some spectators when he was first heard and seen, so fearsome yet so life-like an appearance did he present.

His head was made with a badger's skull, covered outside with the same material as the rest of the body, the jaws lined within with red cloth, care being taken to leave nothing uncovered except the gleaming white tusk-like teeth. The lower jaw fell naturally by its own weight ; but could be easily pulled up by a wire, so that the processes of snapping and champing were most effectively managed. A pair of ears, a red cloth forked tongue and ruby glass solitaire eyes completed the face.

The framework of the body was tolerably simple. Half-a-dozen chip boxes (such as chemists use) of different sizes were procured. An oval or cask-shaped body was made of millboard, and this was tapered off to a long tail-like extremity by connecting it with a succession of chip boxes, diminishing in size, placed at a distance of an inch or less from each other. Another box, midway between body and head, served for neck. When the skin was drawn tightly over this arrangement and folded into a spiny ridge along the top, a sort of vertebrated effect was given by the chip boxes, and flexibility by the spaces between them.

The length from nose to tip of tail was 30 inches ; the girth of the body in its widest part 15 inches.

The "skin" was satin, of a peculiar and very effective hue, steely-blue, shot with sea-green and red. Wings and claws were added, the latter made with wire, with yellow worsted twisted round it.

The creature required to be suspended by three wires—one from each side of the head, another from the middle of the spine, whilst a fourth wire, attached to the lower jaw, passed through the upper (at the nose) for the purpose of working the mouth as already described.

One of the side scenes was painted to represent part of the wall of the Dragon's castle, the painting of the castle being continued also across part of the back scene, the arched portcullised gateway coming in the place where the Dragon enters. The remainder of the scenery represented a wood, through the trees of which (apparently) the Prince enters, with shield on arm and sword drawn in his hand, which weapon is brandished in an impressive manner by means of a special wire attached to its tip. The combat which ultimately ensues is of a most exciting character. The Dragon leaps about, "swinges the scaly horrors of his tail," snaps and snarls, and utters the most fearful sounds, whilst the effect is heightened by hideous noises maintained with great vigour behind the scenes with the aid of a tray, fire-irons, and the combined forces of the company. The Beast at last receives the fatal thrust and rolls over on his side. Once or twice the head is feebly raised, but only to fall again with an expiring groan ; the Prince stands upon the prostrate form and waves his sword triumphantly, while the curtain descends to the music of the "Conquering Hero," and amidst tumultuous applause.

I may just add that when giving the performance it is a good plan to explain to the children something of the story before beginning, and to supply a few connecting links between the scenes, not, of course, spoiling the fun by anticipating too much, but telling them just what is necessary to make things clear and to interest them in what is going to happen.

Finally, it may be of interest to state that the Show, with scenery, properties, and all things needful for one play, cost me about five guineas. Many of the same figures, of course more or less re-dressed, served for the other play the following winter, a further outlay of, say, fifteen shillings, covering the cost of additional figures, dresses, scenery, etc.

This sum does not include the cost of the pair of large curtains used in draping the outside of the stage, as these were not bought, but borrowed when occasion required.

RELIEF STAMPING.

By H. E. GRANTHAM.

RELIEF STAMPING such as is usually found on note-paper and envelopes, is not a very difficult kind of work to master, though those who first try their hands at it must expect to waste nearly as much paper at first as they use, that is stamp so as to pass muster.

The amateur will require the following articles, which should be obtained of some good firm, such as Hughes and Kimber, *West Harding St.*, *Fetter Lane*, *E.C.*, or Harrild and Sons, *Fleet Works*, *Farringdon Street*, *London*, as from such firms the purchaser may be certain of getting first class materials only :—

Stationer's embossing press and fittings costing

from £4 to £8 according to size, one costing about £6 is the most generally useful size, as it will take dies up to about 2 inches long—a great deal of work can, however, be done with a smaller sized press; one ink slab, at 1s.; half pint copal varnish, 1s. 6d.; half pint special stamping varnish, 1s. 6d.; 4 brushes at 3d., 1s.; 1 6-inch palette knife, 10d.; 1 marble muller, 3s.; cardboard for counterparts, 1s. per lb.; sheet gutta percha, 4s. 6d. per sheet, a *small* piece will last a long time, though; and such colours as are wanted to be used, about 2 ounces of each would probably be enough.

It is supposed the amateur has the die already, and he will be able to make a very good "feeding table," and also supply himself with some printing paper of a fair quality, to cut into a convenient size to form a "pad," to clean the surface of the die in relief stamping in colour. A small bottle of turpentine will also be wanted, and it should have a nick cut in the cork to enable a few drops at the time to be readily shaken out. Fig. 1 gives a good idea of the ordinary press, and is lettered for easy reference to the different parts. The desk is shown in elevation in Fig. 2, and in plan in Fig. 3, but as no two firms make the press exactly the same, certain details in the desk would perhaps have to be altered to suit the press supplied.

Having obtained the materials, the first thing to do is to set up the press. I think a strong plain deal table, with an extra leg *jammed up* just under the press, to prevent vibration, as good as anything. It should be placed on the top of the table, about 20 inches from the right hand end, and the centre of the die about a foot from the front edge; this will leave plenty of room to place the "desk" in position. It should be firmly screwed down to the top of the table, and the extra leg before mentioned, be jammed in position just under the die. The "desk" must now be made. The top can be of *soft* deal free from knots—the front and sides of any convenient wood. The shape is shown so clearly in the plan and elevation, that no description is necessary as to how to make it, except that the top should be higher than the top of the die when it is "chucked," about $\frac{1}{8}$ inch or at most $\frac{1}{4}$ inch would be enough, as the object in making it higher is simply to prevent the paper touching the die, except at the very moment of being stamped. The desk must be screwed to the table. If the semicircular hole where the die is is not large enough for the die to be easily lifted out of the press, it must be made larger, and the edge bevelled so as to allow the hand to get in easily. For laying the paper so as to get it straight, small strong needles are used, any ordinary strong needle will do, but if longer than an inch or so should be broken short, and the pointed part used; how they are used will be described further on. Space must be found in some convenient place to keep the colours, brushes, etc., etc., both when in and out of use. The colours must be kept in bottles, corked to keep dust and dirt out.

The press is always furnished with two chucks or holders—one at the bottom of the plunger, which is held in its place by a pin, and which is used for the counterpart, the other to hold the die, and the atter is so made as to be easily lifted out of its place and replaced in *exactly* the same position. The means adopted to attain this end vary with the different presses, and the feeding board or desk must be made so as to allow of the requisite freedom in handling the die-chuck. In speaking of the die in future, I shall take it for granted that it is fast in the chuck, and consequently the chuck itself has to be taken out; thus the phrase, "to take out the die from the press," means that the chuck with the die fast in it is lifted or taken out, the requisite operations performed, and then replaced.

How the different parts of the press are used will be best seen by describing the method of preparing a "job" for work, and I will therefore now proceed to explain the *modus operandi*.

On examining the die it will be seen that at the bottom there is probably a shank, generally round, this is placed in the hole in the centre of the chuck, the die placed as nearly square with the chuck as possible, or convenient, and held firmly down while the screw or screws that the chuck is furnished with for the purpose, are tightened up, and hold the die firmly in its place. The chuck and die are now always spoken of as one thing, and generally as "the die." The bottom of the letters that are cut in the surface of the die are towards the front. It is very rare that the chuck will fit either way, but even if it should, it is best to always use it in one special way. The die is placed in the press, and three pieces of the "counterpart card" are cut, one considerably larger than the die, the other about as large as the top of the die. They are gummed on one side; wet this, and then place the largest card on the top of the die, gummed side up, and then slowly turn the weighted arms of the press, so as to make it *squeeze* slowly on the top of the card, hold it quietly for a few moments, then let go, being careful not to get a rap on the head from the arms as they turn back. The spring is generally powerful enough to force the plunger up to its normal position. Now wet and place the second piece of card on the top of the die, but this time give the arms of the press a "swing round" with one hand, so that the plunger *strikes* on the top of the card which is placed on the top of the die, the plunger will spring up sharply, and the balls as they fly round

must be met and checked with one hand, so as to allow them to *quietly* swing round into the position they occupy when the press is at rest. Now place the third card down as the other two were, and stamp it, but this time repeat the stamping three or four times with moderate force; the reason is that a sharp, full impression of the die is thus obtained on the under surface of the card. While the gum on the counterpart cards is setting fast, get your penknife sharp, especially the point. Take out the counterpart chuck by withdrawing the pin that holds it fast, and with the knife in one hand and the die in the other proceed to trim the superfluous card away, cutting nearly close to the main lines of the work, and holding the knife so that it cuts on the bevel, as shown in the elevation and plan of the counterpart chuck. It sometimes happens that the die prevents the counterpart chuck being taken out, as it prevents it dropping low enough, simply "take the die out of the press," and put it on one side, then take the counterpart out. We now only need to face the counterpart with a thin coating of gutta-percha, and it will be ready for use. Cut a piece of gutta-percha about one-quarter the size of the surface of the counterpart, and softening it by the aid of heat (a gas jet, candle, or something of that sort is most handy) proceed to spread it over the surface of the counterpart by pushing it with the finger tip, kept well wetted to prevent it sticking, until the whole surface is covered evenly over, tear a piece of thin paper (tracing paper is best, I think) rather larger than the surface of the die, and place it handy; warm the counterpart, so that the gutta-percha is quite soft and tacky, place it quickly in the press, replace the die, put the torn piece of paper on the top of the die so as to cover it, and bring the counterpart *gently* down in just the same way as when putting card No. 1 on, keep it down for about half a minute, and then gently stamp it two or three times, leave it about a couple of minutes to give the gutta-percha time to set; then take the counterpart out, and again trim it with the knife.

In trimming, it is better to go a little too far off the work than too close, the latter may cause the ink, in colour work, to "splash" like a little round flat dab of colour instead of a sharp letter. Now replace the counterpart, give it a stamp or two, and try it on a waste piece of paper, not too hard, by placing the paper on the top of the die, and giving a "stamp" with moderate force.

N.B.—Whenever the press is "stamped," the arms must always be checked in their rebound, so that they drop *quietly* into their berth.

The impression just made should look *clear* and *sharp*, the smallest lines *cut* on the die being visible; if not satisfactory try a harder stamp; if the *edge* of the die marks, the corresponding part of the counterpart must be trimmed, as only the letters should show. The smaller the die, and the softer the paper, the more quietly must the press be used. The mark on the paper, caused by the counterpart, should be kept down as much as possible, consistent with the work, showing sharp and clear: the *harder* the *stamp*, the *stronger* the *mark* just referred to.

The next step is to place the pins or needles for laying the paper to. Three needles are used, and as the die has been put in for note-heads, two of them are generally placed on the *left*-hand edge, as shown on the plan, and the third on the bottom. The two first keep the work straight, and in correct position, in regard to the centre, or otherwise of the breadth of the page; the bottom needle regulates the distance from the top of the paper. A sheet of paper is opened out *flat*, placed against the needles as shown, and quietly stamped. If the work is in the proper position and is square, knock the "pins" in and make them safe, so as not to be moved or accidentally knocked out. If the work is *not* straight the pins must be shifted till it is.

In order to obtain freedom in using the press, it is best to stamp "plain" for the first job or two. The whole of the paper for the job is opened out flat, placed on a small table close to the press on the left-hand side, and then as each sheet in turn is taken and stamped, it is placed on the right hand of the operator in a pile. The paper, when stamped, can be gathered up and put once more into the ordinary sets of sixes, as it was before being opened out flat. It will be seen that in "plain stamping" the die is never moved at all; once the press is set for the job it remains in its berth.

In all cases where either of the chucks have been taken out, care must be taken to replace them in the same way as they were before. It generally happens that the die chuck will only fit one way: but if it should fit both ways, it is best to keep it in the way the makers of the press show, either by packing it up with the "holder" *in situ*, or by an engraving of the press. The counterpart chuck should have some mark made on it, so as to readily know which is the *front* side. It may often happen that when the counterpart is in position it is found that the bottom of the plunger does not fairly butt against the top of the counterpart chuck; if this is the case, the chuck must be packed up with paper until the pin requires to be *driven* into its berth; then, and not till then, will the blow given by the counterpart on the die be *sharp* and clear.

In oiling the press use as *little* as possible, especially where the screw butts on the top of the plunger; if too much is used it is apt to splash out

in little drops of oil all over the surrounding paper, etc. The bearings of the plunger must be kept up, but not tight ; remember the plunger must work *freely*, but not be *loose.*

Having become somewhat accustomed to the working of the press, we may now try our hand on a colour job. We will suppose the same die is in and has not been disturbed since the first job was worked, and also that the counterpart is in good condition (it ought to last for at least two or three thousand impressions unless the paper is very hard), and that we are going to work in *red*, or, as some would say, vermilion.

The press itself is ready, so we prepare the ink by putting about a teaspoonful of the "dry" vermilion on the ink slab, over it pour a *little* copal varnish, and mix with the palette knife pretty stiff—*the stiffer it is the better it grinds*, but as the *flat*, not the edge, of the muller is used, it must not be so stiff as if for lithographic printing; it should be ground till quite smooth, then gather up and placed in one corner of the slab near the top. Now take a piece of it, about as big as two peas, and with the "stamping varnish" thin it down, using the palette knife, to the consistency of treacle, and this *thin* pat is the ink to be used. Take a brush proportioned in size to the size of the die ; take a little ink on it, and work it on the slab to get the colour evenly in the brush; take out the die, hold it in any convenient way in the left hand, and brush the surface over with the brush ; put the brush on one side, and place the die face downwards on the top of the "wiping pad," which is formed by about half-a-dozen sheets of demy printing paper cut quarto, and knocked up "straight." The right hand holds the die, the left keeps the pad steady—with a slight and very peculiar twist of the wrist the die is *rubbed* along the surface of the paper, and every trace of ink removed from it except what is in the letters, and has got over the edge of the die ; the latter is of no consequence if the desk is the right height and the counterpart cut properly. The die is replaced in the press, and the paper stamped. If properly done, the result will look clean, sharp, and of full colour and body.

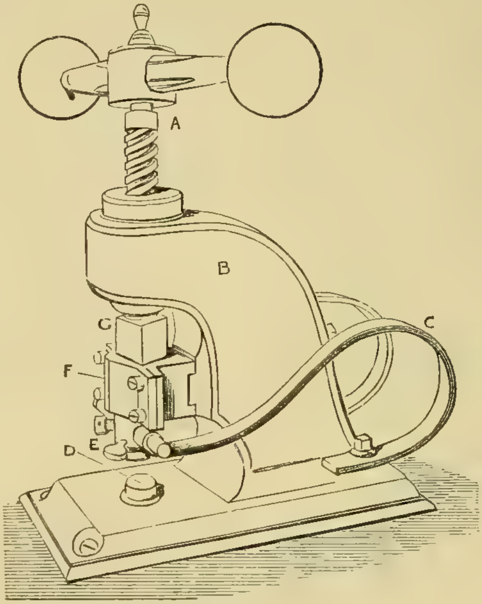


FIG. 1.—ORDINARY SCREW EMBOSSING PRESS.
A, Screw with Weighted Arms ; B, Solid Casting ; C, Springs ; D, Die Chuck and Die ; E, Pin of Counterfeit Chuck ; F, Bearings of Plunger ; G, Plunger.

A millboard, as stationers call it, is placed on the left of the press, as shown in Fig. 4; on this place a sheet of paper to keep *the* paper clean, and place the paper just stamped on the top, so that the top edge corresponds roughly to the top of the millboard, and the right hand edge is also corresponding to the right hand edge of the board, the stamped side of the paper is upwards. When the next piece of paper is stamped, it is placed on the *top* of the one just put down, so that the top edge of No. 2 does *not* touch the stamped work of No. 1, and thus sheet after sheet is laid till the bottom of the board is reached, then a fresh row is started, the new row going on the top of the preceding, but so that the right hand edge of the paper does *not* touch the stamped work of No. 1 row. The whole board is thus gradually covered, then the paper is covered over with a large piece of some light paper which is large enough to cover *all* the stamped work, then another row is commenced just as No. 1 was ; by this plan, a couple of reams of paper can be placed on

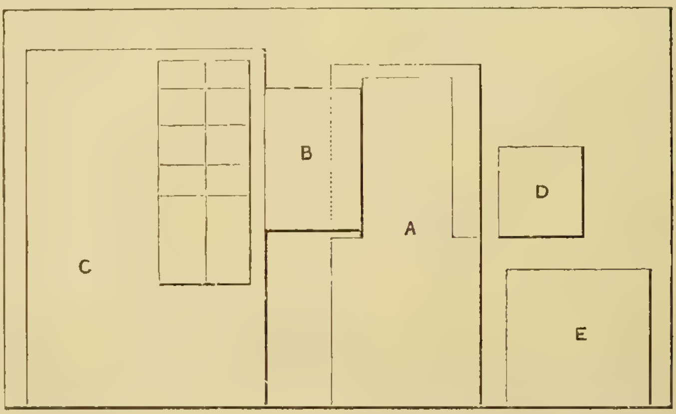


FIG. 4.—DIAGRAM SHOWING ARRANGEMENT OF THINGS ON TABLE.
A, Press ; B, Desk for Paper to be Stamped ; C, Board for the Stamped Paper ; D, Ink Slab ; E, Wiping Pad.

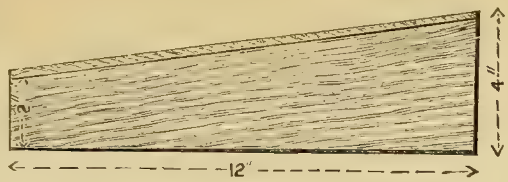


FIG. 3.—SIDE ELEVATION OF DESK.—The sizes given are only approximate. The desk must be fitted to the special press with which it is to be used.

one board, yet there will be no danger of the stamped work being rubbed.

The first impression having been stamped, and the paper placed as just described, the die is taken out, a little more colour is put into the brush, Fig. 5, the die "charged," cleaned, and replaced, and the next sheet of paper is stamped, and so on till the job is completed. When the first pat is worked out, a second one is made up with the "stamping varnish."

The great difficulty at first met with will be to clean the die; the stamper uses considerable *force* in rubbing the die along the paper, and at the same time gives a sort of twisting motion to it; some place the die near the top of the pad, and *draw* it towards the bottom, others do just the reverse: it is purely a matter of practice. The paper used for the pad should not be too rough, or it will take too much ink out of the die, if too smooth it won't clean the die nicely; a paper such as is used for a good newspaper is about right—in fact, the advertisement sheets of periodicals often make splendid "pads."

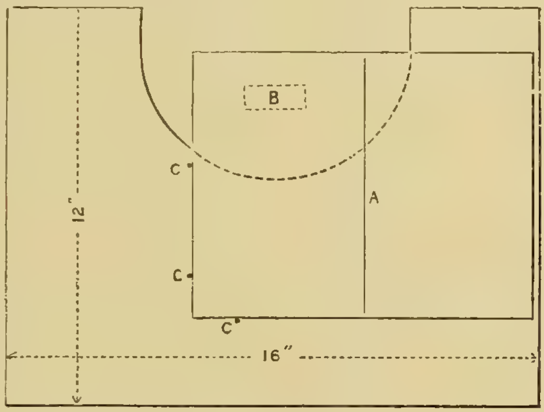


FIG. 2.—PLAN OF TOP OF FOLDING DESK SHOWING SHEET OF PAPER LAID TO NEEDLES.—A, Paper; B, Die; C, Needles.

Great care must be used in keeping the fingers free from ink. Inky fingers are a fruitful source of spoiled paper; when the die is left for any length of time, it is best to "clean it off" with a little turps and a bit of rag, so as to get rid of the ink; this was always done in the office I worked in, when leaving for dinner or the day; in the latter case the ink was also cleaned off the slab, the unused ink put into a sort of round saucer (a number of which fitted into each other, so as to keep the air from the ink), and the slab cleaned off with turps, etc.—superfluous ink was pressed out of the brush, and things left clean and nice.

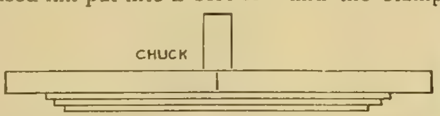


FIG. 5.—ELEVATION OF COUNTERPART CHUCK AND THE COUNTERPART.

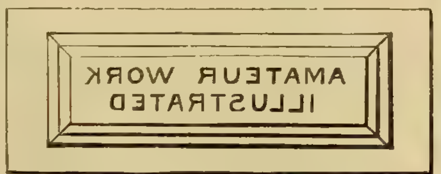


FIG 6.—PLAN OF COUNTERPART.

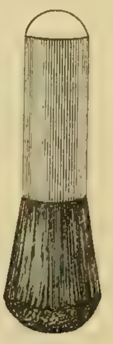


FIG. 7.—BRUSH.

As the different sheets of paper forming the "pad" get used, they should be put on one side, when dry, knock up and place at the *bottom* of the pad, by this means both sides of the paper get used; when both sides are used, the paper is of no further use except to light a fire with.

How to keep the brushes in condition is not very easy to say, so much depends on the amount and *frequency* of use; if to be used the next day for the same colour, I generally dropped a little "turps" on it, and left it; in the morning I worked the brush *soft* with a *little* more turps, getting rid of as much of the ink and turps as I could; but this method is rather risky, both to the colour and the brush. It is apt to weaken the colour for a few pulls, and in process of time makes the bristles fall out; a better plan is to wash them as an artist does his brushes, in warm water and soap; of course, washing well to get rid of the soap. The chief drawback to this is you can't use it till it is dry again.

If half the job is to be done in one colour, and half in another, when the first colour is done with it is cleaned off the slab, the die is cleaned, also palette knife, etc.; the new colour is mixed, a fresh brush is taken, and the work proceeded with.

In stamping envelopes the die is reversed, *i.e.*, the bottom of the letters are *from* the stamper, in other respects the work is similar to that for note-paper; the pins are, however, usually laid two in *front*, *one* at the left hand side; the *flaps* are opened out *flat*, and the stamped work is spread on a board in a similar way to the note paper, only, of course, a greater number can be got on the board before it is covered, as it does not matter how they are placed so long as the wet ink is not touched.

The principal faults met with are, (1) Want of sharpness in the letters; this is generally due either to too thin ink, or to want

of force in stamping. (2) One or more of the letters "splash" at the edge; this is almost always caused by the counterpart being cut too close to the work, take off the *top* card of the counterpart and put on a fresh one, facing it with gutta-percha, etc., as before described. (3) Want of "body" in the colour: the colour is too thin; must try and use stiffer ink. (4) The die won't wipe clean: generally due to want of the "knack," and also often to working too slowly; if it is only slight and does not stamp on the paper, it need not be bothered about until it *does* show on the paper, and in that case rub it off with a little turps, and make the ink a little thinner; by adding a drop of turps to the pat of ink, this trouble will often be got rid of, but care must be used as it is very liable to spoil both the "body" and "gloss" of the ink. (5) The ink on the edge of the die marks the paper. Perhaps the counterpart has not been cut away deep enough, or the desk does not keep the paper high enough. Wipe the offending edge of the die on the "pad," also examine the counterpart, and if necessary, use some temporary "dodge" to make the desk the proper height.

When a die is done with it is taken out of the chuck, the surface well cleaned, and then rubbed with a little oil and wrapped up in a piece of paper to keep it free from scratches.

Cameo stamping is, so far as the result goes, the reverse of relief; in cameo the *ground* is coloured and the letters are the colour of the paper. The ink is specially mixed, pretty stiff, too, with its proper varnish, and a small roller is used to roll the surface of the die with the ink. The dies have to be specially cut, and the counterpart is cut exactly to the edge of the die. The die is left in the press, being "rolled" *in situ*, and the paper is stamped in the usual way. It is a rapid mode of work, especially when an assistant is employed to do the rolling. When stamping in this style there is little need to do more than *scatter* the work over a board, as the raised letters protect the ink and the ink itself is not so thin as in relief.

Stamping in gold or silver is usually done by stamping the work in an ink made almost entirely with gold size; the usual colour I used was a light yellow. The freshly-stamped impression is rubbed lightly over with a camel hair brush *well* filled with the bronze or silver used, and after a light dusting with this brush is placed on the board to dry, which it usually is by the next morning. A piece of tin-foil is put on the surface of the die and lightly stamped, to make it keep on the die. The work is carefully dusted with a broad camel hair brush to remove all superfluous bronze, and then is passed through the press as if for plain stamping. The chief difficulty is to lay the paper *exact*, as if not perfectly exact, the two impressions will not correspond, and then the result is *that* one sheet is wasted. The tinfoil, which costs about 2d. per sheet, is used partly to prevent too deep an impression and partly to brighten the gold.

In making a fresh counterpart it is not always necessary to cut off all three cards used in the preceding one; *one*, the last one, is often enough. When trimming a counterpart the usual plan is to cut through *two* of the cards, only leaving the first card to prevent the knife being spoilt by catching against the iron of the chuck.

The most difficult kind of stamping is generally that of crests and such like, as the crest is cut so deep, and yet the "feathers," "scales," etc., must show sharp and clear. This kind of work demands a brush with only *just enough* colour in, and after charging the die the brush is used in a certain indescribable way to slightly *clean* the crest; with this exception the method of work is just the same as for ordinary relief. The work will generally be dry in about twelve hours, and it can then be gathered and packed up.

I have endeavoured to make the methods used as clear as I can, but nothing but *practice* will ever give the knack required to perform the different operations rapidly, cleanly, and without waste of paper, etc. If anyone finds himself in a hole I shall be happy to do my best to pull him out of it.

REPOUSSÉ, OR RAISED METAL WORK.

By H. C. STANDAGE,
Author of the "Artists' Manual of Pigments," etc., etc.

III.—Artistic Qualities of Various Metals—Consistence of Form in Regard to the Material—Artistic Value of Gold—Plea against Vulgar Ornament in Gold—Silver—Bronze—Copper—Iron—Ornamental Iron Work.

THE ARTISTIC QUALITIES OF VARIOUS METALS.—In a previous paper I incidentally referred to the peculiar ductility and malleability of metals, each kind possessing these qualities in a degree peculiar to itself. In fact, the beauty of the work executed in them depends much on the actual knowledge of how to turn these qualities to his own use in producing the effects he desires. "When we recollect," says Wyatt, "the peculiar properties of the precious metals — their strength and ductility—it must be at once apparent that details of execution can be rendered in them,

which could not be expressed in materials such as wood. Hence, when we seek to elevate, to the highest perfection, technical execution in gold and silver, we must at once perceive that a new field is opened for the sculptor's art. By means of gravers and chasing tools, and by the process of repoussé, which admits of a constant variation of relief, and the correction of redundant form an amount of finish can be given to subjects of an immensely sculpturesque character, such as could not be employed by them when executed by any other method. In the best ages of the goldsmith art, this minute execution was carried to great perfection. By the Greeks, by the Italians of the cinque cento age, by the modern French, and especially by the exquisite artist, M. Vechte, refinements of texture and manipulating have been practised on objects executed in silver as ornaments, which give them a peculiar and distinctive character.

Consistence of Form in regard to the Material.—Every material, insomuch as it differs in organic constitution should vary correspondingly in the forms and proportions into which it should be wrought. Forms wrought in metal that are proper only for stone, or forms in stone that are proper only for metal, wood, etc., are contrary to the true canons of good taste. They are also totally inconsistent. Elaborate execution of detail may, and should be carried in metal to the most minute perfection. "The superior strength," to quote Mr. John Bell, "and composition of metal over other materials, afford the opportunity also for superior fineness of parts in treatment. Those piecings which would be inconsistent with firmness in wood or porcelain, are yet durable in metal; for convenience also, and durability, its weight necessitates, in many cases, a thinness and lightness of treatment. In many instances, such as in the use of the precious metals, to save cost in material, it is advisable to obtain thinness; most of our articles of silver being thus made of plates beaten up into the required form, the ornament being added afterwards. This has to be done carefully, or holes are apt to occur, injuring or spoiling the articles; but if well done, the process of hammering necessary to bring them to the required form produces a superior firmness of substance."

In designing a work to be executed in metal, there are two standpoints from which to base a design: one of these is the utilitarian, the other the artistic. Both classes of designers have a right to their special standard of what constitutes perfection to the principles on which they work, but we do not hear say that either class produces a perfect object—each does according to his own views, but the product of either is only a partial triumph towards the beautiful. We hold that the two standards should go hand in hand. The question is such a hot, debatable one, for which we have no leisure nor space here, that we will attempt no elucidation of it, but leave it to our readers to form their own opinion, and choose one or both sets of principles to work on from the following sage observations of that eminent authority, Sir M. Digby Wyatt:—

"To the first class of bigots (the utilitarians) we may fancy belong the careful cast iron constructionists, who generally build railway sheds *ad infinitum*, and bridges *ad nauseam*, with more skill than tact; to the second (the idealist, the poetical, and sometimes tumbledown genius), who raise imaginary towers on the baseless fabric of a vision, cover dog kennels with crockets and finials, turn stoves and clocks into cathedral facades, make bridges where water flows not, and too often sacrifice comfort and convenience to ornament and effect."

Let it ever be remembered by the provident artist that while it is impossible too highly to sublimate the ideal portion of the art, it is through natural form alone that he can convey to his fellow-men the glowing creations of his imagination. Then he has a double end to perform; to be at once subject to the conditions of the materials in which he works, and master of the art of struggling with the difficulties, and enhancing their beauties, so far as to dignify at once the material and the immaterial portions of his labour. To fitly carry out this object, his studies and his powers should be alike extended, and yet concentrated.

As we have said, designs for any one metal should be made different in style from those suited for any other. "We are too apt," says Bell, "in endeavouring to overcome the mechanical difficulties of working inherent in any substance, to overleap the work, and fall on the other side." Thus, in bronze and brass work, we rush into a frittering, flimsy imitation of fluttering draperies in order to exhibit our perfect mastery over the difficulties of complicated casting. Now, by another and simpler mode of treatment the effect produced might have been infinitely better. We might at once acknowledge the grandeur and propriety of a majestic colossal sphinx, in granite or porphyry, but let Dorothea, or any other popular piece of elegance be worked out in one of the same materials, and our only feeling will be how very much better it would have been in marble, alabaster, or biscuit. It is ten chances to one, too, if in the attempt to display our manual dexterity, we do not altogether lose sight of propriety of form and adaptation of line to the direction of subject, etc. Thus, in some of those highly twisted scrolls, bent in all kinds of ways, and surrounded by all sorts of fruits, flowers, dolphins, cupids, monsters, etc., we are an-

noyed with a mechanical dexterity, which, more moderately exhibited, might have pleased us, now it frequently disgusts.

Artistic Value of Gold.—Gold is the most valuable of all metallic substances, with the exception of platinum; it is the most malleable and ductile, the most beautiful in colour and brilliancy of surface, and it is the least susceptible of oxidation. From the possession of these qualities we may assume that it is most fitly destined for employment in a massive form, in small objects only, on account of its rarity; in sheet, filigree, and wire, of the most exquisite tenuity, on account of its malleability and ductility, in the highest decoration, extended superficially on account of its colour and beauty of surface, and as a covering, revêtement, or protection to other metals more easily injured by exposure to the air on account of its extraordinary power of non-oxidation.

Plea against Vulgar Ornament in Gold.—When we reflect on the extreme beauty of gold, on its great value, and on its association with all that is rich and brilliant, it is the more to be regretted that art is so rarely allied to manufacture or its elaboration. It appears as if the old idea of barbaric magnificence still clung to its use—that while in bronze and in the baser metals the artist feels deeply, or at least acknowledges the responsibility of his profession, in gold any style of form is admissible, and that a multitude of sins are condoned by the brilliancy of sparkling jewels and the value of the metal which surrounds them. It is most remarkable that while sums of almost any amount, determined only by the caprice or fashion of the day, are constantly given for diamonds and other precious stones, the nature of their setting should receive so small an amount of attention. It would indeed be a triumph of art so to elaborate the precious metal surrounding the diamond, or to make the frame more beautiful than the picture it contains.

Artistic Value of Silver.—Silver is next in value, durability, and malleability to gold, and though liable to tarnish, is easily cleaned by friction. It seems, therefore, naturally adapted to be worked in plates, to be beaten to its requisite degree of high or low relief, to be used in the massive form in larger objects than gold, not to be so susceptible of extension over large surfaces, but admirably adapted to protect and ornament the baser metals in all household vessels and implements which require frequent rubbing to keep them fit for use.

Repoussé Work in Silver. — It is one of the agreeable features of this process that the metal can be used in the greatest degree of tenuity. While its effect in that state is even better than it could have been had the metal been more substantial, and while the art is more excellent, the cost of the above is so far reduced that it becomes a question, the solution of which scarcely admits of a doubt, whether the nature of the material should not be entirely disregarded, and the whole value of the object made to depend upon the art which may be lavished upon it.

Artistic Value of Bronze.—Bronze, from its intractability and brilliance, excessive hardness of surface and facility of fusion, seems to demand for itself a completely different line of treatment from silver. Casting and chasing appear its proper and legitimate province, and it lends itself with singular felicity to the reproduction of the highest order of sculpture. Its compact texture, evidenced by its peculiar sonorous properties, dictates a system of hollow casting; and it is only in the most barbarous ages that it has ever been used in the massive form.

Artistic Value of Copper.—Copper, from its malleability and toughness, is peculiarly adapted to the formation of domestic vessels by hammering and stamping.

Artistic Value of Iron.—The twofold nature of the properties of iron, in its cast and in its wrought state, are so well known, that it is scarcely necessary to dwell upon them; but we may be contented with remarking that the usual effect of iron is essentially to strengthen and construct. It is most consistently employed, excepting where it serves as a support, in the massive form of solid casting, or when bent and wrought in simple forms upon the anvil, filed to regularity of surface and angle, and punched into open-work plates by intense force; and thus elaborated it should be strictly applied to utilitarian purposes.

Ornamental Iron Work.—The surface of an iron casting just removed from its matrix presents an appearance of colour closely resembling copper, whilst any roughness or superfluous metal indicates imperfections in the mould, to remove which, when the forms are simple, the file and turning-lathe will generally suffice. When a careful degree of finish is needed, the work requires to be chased up. When the surface to be cleaned is of a "mottled" kind, the aid of acid is called in, by immersion in which a uniform brilliant or a dead gold appearance is secured. It is in this particular that modern iron-founding differs from that executed by the skilful artisan of the middle ages, who produced a finished surface by friction or by gilding through the medium of the mercurial amalgam. In acid finish, attention must be paid to the entire removal of grease, and a preliminary cleaning is absolutely necessary. In the final operations the acid requires to be completely penetrating, otherwise the action will continue, and the surface be destroyed. The dead gold appearance of much of the modern iron work was the result of a

discovery which arose out of an accidental circumstance: a piece of work having been left in the acid during the night, this work was acted on successfully, and produced the desired effect.

The majority of brass work produced on the Continent is still gilt, but the gilding can be closely imitated, if some little care is taken in the composition of the metal, and if friction with a "scratch-brush" be applied after dipping; the burnished portions in brass finishing are produced by steel burnishers, a little ox-gall being applied to prevent scratching. During this last process, the objects are kept well wet from time to time by immersion in water and argol, and after being "dried out" in boxwood sawdust, they are protected from oxidation by a coating of lacquer composed of spirits of wine, and coloured with a vegetable matter. The article to be lacquered is heated, and the lacquer applied with a camel-hair brush.

(*To be continued.*)

SMITHING AND FORGING.

By GEORGE EDWINSON.

IX.—IRON HURDLES—FENCES AND GATES.

READERS of a previously published series of articles on "Handy Work in Farm and Garden," will remember that I therein gave directions for making wooden hurdles, wooden fences, wooden gates, stiles, etc., and also introduced the subject of wire fencing. As this, together with iron fences, comes somewhat within the province of smithing, I purpose going further into the subject in this paper.

Iron Hurdles.—These are made and sold in a large variety of patterns, and are superseding wooden hurdles in all districts except those where small wood is cheap, and a drug to the occupier of the land. The low prices charged for good iron hurdles by such firms as those of Messrs. Bayliss, Jones, and Bayliss, *Victoria Works*, *Wolverhampton*, almost preclude the thought of making these in the amateur workshop. I give for example the light sheep hurdle shown at Fig. 176, as one easily made by the amateur smith, and for which Messrs. B., J., and B. charge 1s. 7½d. per yard, delivered in Glasgow or Dublin. The dimensions and quantities for this hurdle are as follows:—

½ inch iron rod for three lower bars	18 feet.
⅝ " " " " top bar	6 feet.
$1\frac{1}{4} \times \frac{3}{8}$ flat iron bar for ends	7 feet.
$1\frac{1}{4} \times \frac{1}{4}$ " " " for central stay	2 feet 6 in.

The dimensions of the finished hurdle are to be:—

Total length over all	6 feet.
Total height " "	3 feet 6 inches.
Height when sunk in position ...	2 feet 6 inches.

The method of making this hurdle is most simple. Cut off two 3 feet 6 inch lengths of $1\frac{1}{4}$ by ⅜ inch flat iron for the ends. Heat the lower ends, cut off the corners to form the points, and finish these off whilst hot with a few blows from the hammer. Just the tips of the top corners may be treated in a similar manner. The central stay will only need the top corners cut off. Next drill the holes for the bars in the end pieces and the central stay. One inch from top, drill in each end-piece a ½ inch hole. From the centre of this, $10\frac{1}{2}$ inches down, drill a ⅜ inch hole in each piece. From this, 8 inches down, another ⅜ inch hole; then, at a distance of 7 inches, another ⅜ inch hole for the lower bar. The centre stay must have, respectively, a full ⅝ inch hole for top bar, and three full ½ inch holes for the other three bars. The ends of the bars may be filed down to fit the holes in the hurdle ends, or the tips of the bars may be heated and drawn down to fit the holes. If the tips are to be filed down, the holes may be drilled $\frac{1}{16}$ inch larger, and in this case it will only be necessary to file the tips enough to just show through on the other side of the hole, the hole will take up the rest as the end is being riveted, and form a close-fitting shoulder. Rivet in all the bars to one hurdle end, then drive on the middle stay, and finally rivet the other ends of the bars to the other hurdle end. The stay may be secured in the middle of the hurdle by slightly burring the bars on each side of the stay with a cold chisel, or the holes may be drilled the same size as the bars, and the stay shrunk on; that is to say, it must be heated to expand the holes, and then quickly driven into position, where it must be allowed to cool, when it will shrink on tight to the bars. The feet of the hurdle may be made plain, as shown at Fig. 176, if for sheep and light work, but they must be made as shown, Fig. 177, if intended for heavier work as fences against cattle. This form of foot is made by welding on a piece of iron long enough to form the fork, then bending it as shown in the figure, or by making the foot as shown, Fig. 177A, and fasten on with rivets. The central stay should also have a spiked foot, twisted as shown at Fig. 178. Iron hurdles may be made in several sizes and of various materials, as herein described:—

1. Flat bar iron ends and round bar rails.
2. " " " " " flat bar rails.
3. Angle iron ends and round bar rails.
4. " " " " flat bar rails.

Additional strength is secured by having the top bars of oval section iron, by placing the bars closer

together, by multiplying the number of stays and fitting these with feet, and by using stouter iron in every part. Strong ox hurdles are made with $\frac{3}{4}$ inch round iron for top bar, and six other $\frac{5}{8}$ inch bars riveted into 4 feet 6 inches by $1\frac{1}{2}$ inch by $\frac{3}{8}$ inch iron ends, strengthened by two proportionately strong stays. Such hurdles are sold at from 3s. 6d. to 4s. per yard. Each hurdle, as made, is furnished with a square link of iron on the top bar; this is shown at Fig. 176A, and is put on before the bar is riveted to the end-piece. The use of this link is to slip over the end of the next hurdle, and so unite the whole series in one continuous fence.

Ornamental Hurdles and Iron Fences.—Owners of flower gardens and lawns which may need protection from the inroads of sheep and cattle, will be glad to have a more ornamental fence than can be made with the common form of hurdle shown in Fig. 176. To meet such requirements, I have given a few designs for ornamental hurdles. Fig. 179 is a design for a strong ornamental hurdle of the following dimensions: Length, 6 feet; height, 5 feet 2 inches. Ends and horizontal bars of $1\frac{1}{2}$ inch by $\frac{5}{16}$ inch flat bar iron. Vertical bars of round $\frac{1}{2}$ inch iron. Five 9 feet 6 inch lengths of $\frac{1}{2}$ inch round iron for the bow top vertical bars. Drill the holes for these 6 inches apart from centre to centre. Eleven 2 feet lengths of $\frac{1}{2}$ inch round iron for the lower vertical bars. Drill holes for these, 3 inches apart, from centre to centre. Point each bar and drive in tight upwards, then slightly burr the lower ends. Drive the bowed bars downward and burr the lower ends. Fig. 179A shows another style, with spear heads to the long vertical bars instead of bowed ends. The dimensions are the same as for Fig. 179. When a fence is made up of these hurdles, the feet should be constructed and fixed as shown in the figure, where the ends of two hurdles are shown. As a means for additional strength, holes may be drilled in the tops, and these bolted together. The price of these hurdles is from 6s. to 7s. per yard.

Figs. 180 and 181 are two designs for lighter ornamental hurdles, suitable for forming divisional fences between cottage and villa gardens and allotment grounds. The end uprights and horizontal bars are of $1\frac{1}{4}$ by $\frac{1}{4}$ inch flat bar iron, and the vertical bars of $\frac{5}{16}$ inch round iron, placed 2 inches apart from centre to centre. These are made in 6 feet lengths, and in heights varying from 2 feet 6 inches to 4 feet. Their selling prices are from 4s. to 5s. per yard.

Where it is found desirable to fence gardens and allotment grounds against the incursions of ground game, recourse must be had to fences with close vertical bars. Figs. 182 to 186 show four designs for light ornamental hurdles intended as a protection to crops from ground game. The end uprights are of $1\frac{1}{4}$ by $\frac{1}{4}$ inch, and the horizontal bars are of 1 by $\frac{1}{4}$ inch flat iron. The vertical bars are of $\frac{1}{4}$ inch round rod iron, and are placed $1\frac{1}{4}$ inches apart. They are made in 6 feet lengths, from 2 feet 6 inches to 4 feet in height, and sold at prices from 4s. to 5s. per yard. Lighter and lower hurdles for flower borders and the edges of lawns may be made of similar patterns with two horizontal bars only, and these are sold at from 2s. 6d. to 3s. per yard. A good substitute for these hurdles, where open rail and wire fences are already in existence, may be found in $1\frac{1}{2}$ mesh galvanized iron netting made fast to the rails of the fence with wire ties or with iron staples. This, to prove effectual against the inroads of rabbits and hares, must have its lower edge buried some four or five inches beneath the surface of the soil under the lower rail of the fence. The width of the netting for garden fences should be 36 inches, and the price of this, according to size of wire, is from $4\frac{1}{2}$d. to $8\frac{1}{4}$d. per lineal yard. Suitable staples for fastening the netting are sold at 3s. 6d. per thousand for $\frac{3}{4}$ inch, and 5s. per thousand for 1 inch. Lighter netting for borders may be bought at $1\frac{1}{4}$d. and $1\frac{1}{2}$d. per lineal yard.

At the time of writing this article there appears to be a good prospect for an increase of small holdings of land and of allotment grounds. Efforts are being made by men of both political parties to win back to the soil those of its sons who have been driven from it by the adverse circumstances attending huge monopolies of the land by moneyed men. I hail with pleasure those efforts which tend to conserve the independent spirit of English workmen, and develope their muscles and sinews, by giving them a practical interest in the land. During a visit to a Hampshire village last spring, I had an opportunity of studying the effect of the allotment system upon its holders. Although the land was not the most fertile in England, I found the allotments highly prized by their holders, as a means whereby they could help themselves to provide against scarcity of work and food in winter time. The men held their backs straight and looked one full in the face, thus presenting a favourable contrast to others who lived a hand-to-mouth dependent existence between harvest wages in summer and the dread of out-door relief in winter. One sturdy holder of two acres, beside his own freehold acre and cottage, assured me that he could make a decent living out of the produce from his three acres of ground. He is an aged man, a retired blacksmith, living comfortably with his wife in their own cottage on the hillside, where they cultivate garden produce, rear pigs, keep bees, and in other ways make their three acres yield to them its strength without the aid of a cow. Although in close proximity to extensive game preserves, they did not fear the incursions of

its inhabitants ; but others in similar situations will do well to guard their holdings by the means herein suggested.

It is sometimes necessary to guard the crops in allotment grounds from injury by trespasses of larger animals, and, in such cases, the unclimbable form of hurdle or fence should be used. Figs. 187 and 188 show some patterns of such hurdles, bolted together as shown at A. Fig. 187, B, shows a simple pattern made with vertical round or square bars with pointed tops. The vertical ends and the horizontal bars are made of $1\frac{1}{2}$ by $\frac{3}{8}$ flat bar iron. The long vertical bars are of $\frac{5}{8}$ inch iron, either round or square as required, in 4 feet lengths, placed 6 inches apart. The short dog bars are of $\frac{5}{8}$ inch iron, in 2 feet lengths, placed 3 inches apart or mid-way between the longer bars. The next figure, C, shows a slight variation, in the introduction of a spear head to the long vertical bars. This can be easily forged by upsetting the end of each bar, pointing the upset part and then flattening it to the form shown. The next figure, D, shows another variation made by using flat 1 by $\frac{1}{4}$ inch bars at distances of 5 inches apart inserted in two horizontals only. The heads of these bars are first pointed, then nicked on each edge with blunt setts to form the neck of the spear ; they are held in long slots cut in the top horizontal bar, and are secured to the bottom bar by the ends being rounded, inserted in round holes, and riveted to the bar. When the sharp upright spikes of Fig. 187, B, are objected to, they may be bent over against possible intruders as shown at Fig. 188, and in this form prove even more formidable to trespassers. If one or two barbed wires are run along on the outside of the fence and secured to the bars at frequent intervals with wire, the fence will be impregnable to loungers and rubbers as well as trespassers.

Fig. 189 gives the idea of a more permanent continuous unclimbable iron fence of an ornamental character, suitable for fencing large enclosures contiguous to roads. The top horizontals may be $2\frac{1}{2}$ inches by $\frac{1}{2}$ inch ; the bottom ones, $2\frac{1}{2}$ inches by 1 inch ; the pillars, $2\frac{1}{2}$ inches square ; and the vertical bars of $\frac{3}{4}$ inch square iron. The vertical bars, 5 feet in length, pass through the top horizontal, and are firmly riveted into the bottom one. The bottom horizontal is bent down at a right angle with the foot of the pillar, and is bolted thereto, whilst the top horizontal is secured to the top of the pillar by tenon and socket. The pillars are placed at distances of 9 feet apart, and their feet are firmly fitted into stone blocks. Any one of the patterns shown at Figs. 179, 179A, 180, 181, 186, and 187, may be used in the make up of dwarf rails or palisading for fixing on dwarf stone walls or to stone blocks. For the former purpose, the height may be reduced to 2 feet 6 inches, and in all cases the vertical end pieces of flat bar iron must be replaced by stout iron pillars when the fence is to be fixed to stone. It is also advisable to strengthen the fence by using stays, as shown at Fig. 191, to each length of 9 feet ; and "droppers" from the underside of the lower horizontals into the coping of the wall, half way along each length between the stays. These, and the feet of the pillars are secured to the coping stones in the following manner :—

Sockets slightly larger than the feet of the pillars or droppers are cut with a cold chisel in the stones to a depth of from 2 to 3 inches, or more if required. The corners of the feet are notched with the chisel, then the feet are inserted in the sockets, and molten lead is poured from a ladle into each socket whilst the fence is kept steady. Keep the fence still whilst pouring the lead, and until it has set ; see that the socket and the foot are quite dry, and fill up the socket level with the surface of the stone.

Fig. 190 shows a very useful iron fence specially suitable to situations exposed alike to cutting winds, attacks of ground game, and trespasses from cattle. It is a combination of the barbed wire fence and close game-proof palisade. The standards of this fence are of T-iron 2 inches by 2 inches by $\frac{1}{4}$ inch, by 8 feet 6 inches in length, placed 6 feet apart. Each standard is fitted with an anchor foot, as shown at Fig. 192, and this takes up 2 feet 6 inches of its length. It will be seen from the sketch that this foot is made by bending the foot of the standard and riveting on an extra piece of iron to the junction of the bend, thus forming a fork. The end-pieces are of stout angle iron, fitted with wire strainers (shown at Fig. 193) for straining the barbed wire. The spaces between the standards from the ground to a height of $4\frac{1}{2}$ feet is made into an open panel or frame by riveting two lengths of $1\frac{1}{2}$ inch by $1\frac{1}{2}$ by $\frac{1}{4}$ inch angle iron to the standards. To these horizontals, three 2 feet widths of corrugated galvanized sheet iron are secured by rivets, and thus a close wind and game-proof fence is formed. Above these panels are run two four-barbed steel wires, and these are secured to each standard by cutting a slit in the edge of the iron with a cold chisel, and laying the wire in the slit. This fence will cost, from the makers, about 9s. 6d. per yard. Corrugated sheet iron, 9 feet by 2 feet, costs about 4s. 2d. per sheet ; rivets, 6d. per pound ; barbed steel wire costs about 7s. 6d. per 100 yards ; wire winders and strainers cost about 10d. to 11d. each, or from 9s. 6d. to 10s. 6d. per dozen.

Iron Gates.—Iron fences will need iron gates to match. The frames for these may be plain or ornamental, just as may be desired to match the fence.

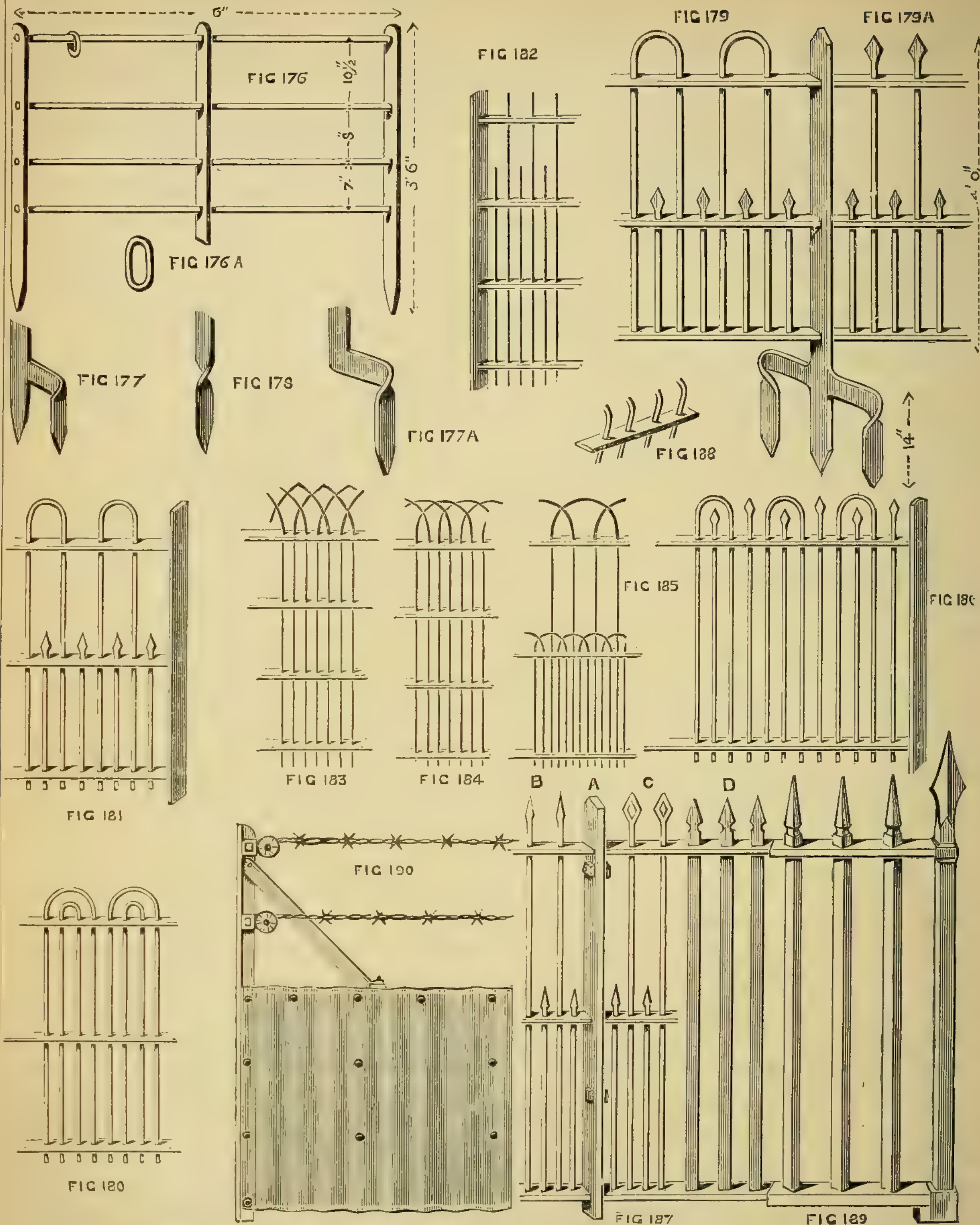


FIG. 176.—SHEEP HURDLE. FIG. 176A.—HURDLE LINK. FIGS. 177, 177A, 178.—FEET FOR HURDLES. FIGS. 179—181.—DESIGNS FOR ORNAMENTAL HURDLES. FIGS. 182—186.—DESIGNS FOR GAME-PROOF ORNAMENTAL HURDLES. FIGS. 187—189.—DESIGNS FOR ORNAMENTAL UNCLIMBABLE FENCE. FIG. 190.—COMPOSITE UNCLIMBABLE WIND, GAME, AND TRESPASS-PROOF FENCE.

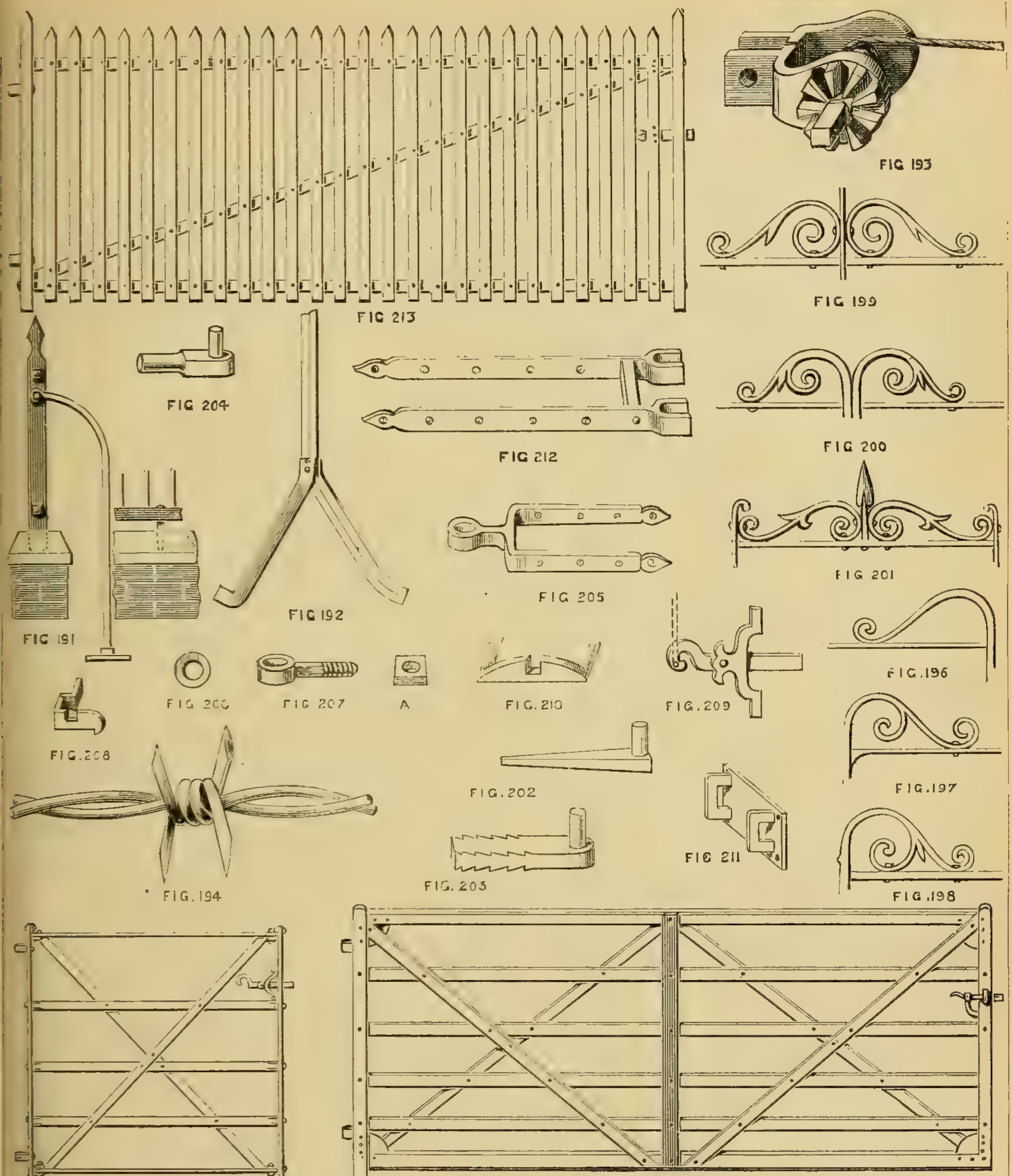


FIG. 191.—STAY AND DROPPER FOR IRON FENCE. FIG. 192.—FOOT OF IRON FENCE STANDARD. FIG. 193.—WIRE WINDER AND STRAINER. FIG. 194.—FOUR-BARBED STEEL FENCE WIRE. FIG. 195.—IRON WICKET. FIGS. 196—198.—ORNAMENTAL SCROLLS TO IRON GATES. FIG. 199.—DITTO FOR CENTRE OF TOP. FIG. 200.—DITTO FOR FOLDING GATES. FIG. 201.—DITTO FOR WICKET GATE. FIG. 202.—GATE HOOK FOR WOOD POST. FIG. 203.—DITTO FOR STONE POST. FIG. 204.—DITTO FOR IRON POST. FIG. 205.—HANGER FOR WOODEN GATE. FIGS. 206, 207, 207A.—HANGER, COLLAR, AND NUT FOR GATE. FIG. 208.—CATCH FOR IRON WICKET. FIG. 209.—LATCH FOR IRON GATE. FIG. 210.—CATCH FOR SELF-SHUTTING ENTRANCE GATE. FIGS. 211, 212.—HANGER AND FITTINGS FOR LOWER PART OF BACK STILE TO SELF-SHUTTING ENTRANCE GATE. FIGS. 213, 214.—FIELD GATES OF IRON.

Fig. 195 is a design for a plain iron wicket or hand gate. This gate may be made of light 1 inch by ¼ inch flat bar iron, except the back stile, which should be 1½ inch by ½ inch iron. The parts are secured to each other by rivets throughout, the hangers being riveted into the back stile. These gates may be made in any size from 3 feet to 4 feet square, and may be hung to wooden posts or to iron pillars. Suitable cast iron pillars cost from 10s. to 15s. each. Fig. 202 shows a design for a plain field gate to be used with unclimbable fencing. The dimensions are 9½ feet by 4½ feet; ends, horizontals, and stay, of 1½ inch by ⅜ inch angle iron; bars, of 1½ inch by ¼ inch flat bar iron, pointed at top, placed 2½ inches apart, and riveted to the frame. Fig. 203 is a design for a strong field gate. The dimensions are 9 feet by 4 feet; top and lower bars, of 1½ inch by ⅜ inch T-iron; ends, of 1½ inch by ⅜ inch angle iron: brace bars and stays, of 1¼ inch by ¼ inch angle iron; bars, of 1 inch by ⅜ inch flat bar iron. Quadrants of sheet iron are riveted to the corners to strengthen them, and the whole is firmly riveted together. Gates for the various patterns of iron fences and hurdles may be made up to match the fences with bars of a similar design and size. Gates with a stout frame of flat bar iron may be filled up with various styles of bars and stays, as for example—1. Four flat intermediate bars and one vertical stay, with two diagonal stays crossing in the centre. 2. Four flat intermediate bars and two vertical stays, one at 2 feet from front of gate, the other half way between this and the back stile, and this crossed with two diagonals. 3. Same as the first, but front and back both crossed with diagonals. 4. Same as first, with the addition of two short vertical stays and a long bow stay from foot of front to centre of gate, then down to foot of back stile. Round or square bars may also be used, and these made to pass through holes in the stays. Space fails to give designs of all the various forms of iron gates, stiles, and fences in general use, but I have given a general idea of them.

Where it is desired to ornament the tops of the stiles with scrolls of wrought iron, the designs, Figs. 196, 197, and 198, will show how this can be done. Fig. 199 shows an ornamental wrought iron scroll, suitable for the top of a large gate. Fig. 200 shows scrolls for the ends of double or folding gates. Fig. 201 is a design for the top of a small ornamental wicket. These designs may be easily worked out with the ordinary tools of a smith. They should be drawn with slate pencil on a piece of sheet iron, then filled in with white lead, and the work compared with the design as it proceeds. At some future time I may enlarge upon this subject, and give several designs for ornamental wrought iron work requiring other tools than those hitherto mentioned in these papers. Hangings and latches for gates are made in great variety, but the most common and useful forms are shown at Figs. 202 to 212. Fig. 202 shows a gate hook for a wooden post. This is forged out of 1 inch square iron. The end of the bar may be first forged round, then bent back to form the hook. The elbow is then upset and thus thickened, then the hook is formed by driving it into the round swage hole on the anvil, or into a similar convenient sized hole in a block of iron whilst at a white heat. The tang is finished after the other part is forged to the required form. Sometimes the tang takes the form of a bolt with a threaded end, and this is made to pass through the post, when it is secured by a nut on the other side. Fig. 203 shows the form of tang for insertion in a stone post into which it is secured with molten lead. Fig. 204 shows a hook for an iron post. The tang of this hook is made to fit tightly in a hole drilled through the post, and is then riveted to the other side. The hanger to match this is shown at Fig. 207, being there sketched as used for a wooden gate. When it is to be used for an iron gate the threaded part may be dispensed with and the tang riveted to the hindermost stile of the gate. Fig. 205 shows the usual form of hanger for wooden gates. When entrance gates are to be made on the self-shutting principle, the lower hanger must be made similar in shape to that shown at Fig. 212, and the prongs made to engage with two pins fixed near the bottom of the gate post. Fig. 211 shows an easy way to do this. Two stout square staples are riveted into a stout iron plate, and this is secured to the post by screws. The hanger shown at Fig. 212 is also of simple construction, the two prongs being united by a short square bar riveted into each arm. When hangers for iron gates are to be made on this principle, their shanks should be squared and fitted into square holes in order that the jolting motion may not displace them. Fig. 210 shows the catch that is usually adopted with this style of gate. It can be easily adapted to wood or to stone posts, and modified to suit iron posts. Fig. 209 shows a design for an ornamental latch suitable to a wooden or an iron gate. When such latches are used on an entrance gate, or on roadway gates leading to bridle paths, it is well to fit them up with whip or riding latches. The simplest form is secured by attaching a ⅜ iron rod to the crook of the latch, as shown by the dotted lines at Fig. 209, and make this rod long enough to stand one or two inches above the top bar of the gate, where it terminates in a loop and is held in a staple. This loop can be pressed down with a whip handle, the latch raised, and the gate opened. Fig. 208 shows the ordinary form of catch for a small iron

gate falling to a light iron post. The square tang is fitted into the post and riveted there.

Much more might be written on iron fences, how to make and repair them, and the tools used for the purpose. I cannot go further into the subject now, however, for other work demands my attention. Readers interested in the subject will be able to get further instruction from the articles on "Handy Work in Farm and Garden," published in Vol. IV.; from a little book on "Farm Roads, Fences, and Gates," published at 2s. 6d. by Messrs. Crosby Lockwood and Co.; and from the splendidly illustrated catalogue of Messrs. Bayliss, Jones, and Bayliss, *Victoria Works, Wolverhampton.*

(*To be continued.*)

CLOUD NEGATIVES.

By JOSEPH HARRIS.

FROM an artistic point of view it is safe to assert that no landscape photograph is a work of art without its effect of cloud. However well the story may have been told, however beautiful may be the transcription of nature, unless the eye can rest upon a sky in harmony with the picture, the charm of the composition is wanting.

In this country we look for cloud in a rendering of sylvan beauty; the limpid streamlet may meander by tangled thicket, or by rugged rocks, and we expect the glorious masses of cloud to be mirrored in the slowly moving surface beneath, simply because of the rarity with which the azure vault undisturbed by cloud canopies this part of earth's fair surface called by us denizens—home.

Clouds to our pastoral scenes are as a part, and no one with the slightest pretension to art feeling would venture to compose his photograph without them, or *to buy his cloud negative ready made.* He would not deprive himself the pleasure of enjoying one of the most fascinating occupations of the photographer, the one which so well trains the eye for instantaneous effect, which so materially assists the study of composition. Some writers urge difficulties anent cloud negatives—all the greater the incentive to success. It may be that the gelatine plate does not readily lend itself to the production of *perfect* cloud effect, granted. The gelatine film is too sensitive, there is no *absolute clear glass in the shadows, and the slightest trace of deposit or tone in this particular is fatal to the beauty of a cloud negative.*

The Woodbury tissue is an exception to the aforesaid condemnation of gelatine for cloud effect. On this new material the most charming sky pictures can be made with the greatest facility and certainty, always provided that the masses compose well. The best time for taking them is in the months of March and April, when the rolling masses are driven rapidly and majestically through the ether by the winds then prevalent. The configuration changes incessantly—that which an instant past was destitute of beauty may momentarily assume an infinite grandeur. The operator must stand all attention at his camera, and study the approaching cloud speeding nearer to the field covered by the lens—perfection of outline, matchless symmetry, all is before him with, perchance, a slight turn of the instrument to right or left; *do not be in a hurry*, cap off and on without flourish or excitement, and the glorious scud has been impressed upon the sensitive film.

These photographs should be taken from an elevation, as a house top; *tilt the camera* till the horizon line comes about one-fifth the dimension of the picture from the base line, focus, note the amount of field covered by the objective, which should be a rapid rectilinear or symmetrical stopped to about one-third of its aperture, cap off and on *sharp, do not use the swing back.*

The most effective clouds are those taken at an angle from 30° to 45° from the sun; the outlines are more brilliantly illuminated than when the aforesaid angle is increased from 45° to 60°. The main portion of the cloud should lie somewhere midway between the top of the plate and the horizon; broken masses covering the field are showy, and at times most valuable, but are not of such general utility as those in which one or two clouds, helped by smaller ones, resolve themselves into a picture. The size of the plate on which a cloud has been taken should correspond with the size of its landscape plate. Clouds on 10 inch by 8 inch plates are out of proportion for cabinet pictures.

By far the richest effects in cloud are produced by the wet collodion process, but the care required, and the delicacy of manipulation involved, are far greater than with the Woodbury tissue.

At the present time a generation of photographers is around us knowing nothing whatever of collodion and the silver bath; this information is valuable, even though it may not often be required.

The plates to be used are the best flatted crown. Clean them with a pledget of cotton wool dipped in nitric acid one part, water eight parts, rub both sides with a circular motion, taking care to clean the sides and edges of the glass, rinse under a tap, and at once coat with a substratum composed of the white of a new-laid egg, well beaten in 20 oz. of water; filter through blotting paper. Avoid air bubbles in pouring about one ounce of the fluid in a two ounce measure; flow a pool carefully in the centre of the plate, which

is held in the left hand, perfectly level, its length towards the body, allow the solution to incline to the right top corner, then to the left top, now towards the hand supporting the left bottom corner of the plate, draining off the surplus into the sink by the right lower corner, rear face to the wall, on clean bibulous paper to dry, out of dust and draught. The substratum must be used fresh for each plate, and poured on free from air bells.

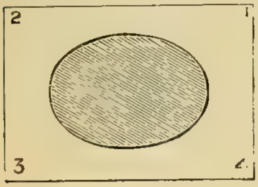


DIAGRAM ILLUSTRATING METHOD OF COATING PLATE WITH COLLODION.

When the prepared plates are perfectly dry, they are ready for coating with collodion. This should be either Thomas's for iron development, procurable at 10, *Pall Mall,* or Hardwick's, from Rouch and Co., 180, *Strand.* The plate should be held as for substratum coating, by the corner, at 3, pour the collodion so as to cover the glass in the proportion indicated, let it flow to 1, then to 2 and 3, returning the surplus to the bottle at 4.

Do not hurry this operation, keep the plate level, the slightest inclination to 1 will cause the collodion to flow almost of its own accord, when the corner has been reached to within an eighth of an inch, alter the inclination of the plate to corner 2, conducting the operation with steadiness; the test of good coating is not one drop of the fluid should be spilled. When the surplus has been removed to the bottle, give the plate a slow rocking motion in the neck thereof, stand the collodion aside, and hold the plate in a contrary direction from that in which it has been draining, so that lines caused thereby may disperse themselves into one uniform and even coating, touch the corner at 4 to judge if the film has become "set;" it is then ready for immersion in the silver nitrate bath.

This solution is made by dissolving *triple crystallized* silver nitrate in the proportion of 3 oz. to 48 oz. pure distilled water, render very faintly acid with dilute nitric acid, four or five drops will be sufficient for the above quantity, filter through Swedish filtering paper, pour into the *glass* dipping bath (*not ebonite or porcelain*), coat a plate with iodized collodion, and leave it in the bath for twelve hours to iodize the solution; it is then in perfect condition.

Do not tamper with the bath, as by "sunning" it, by adding one nostrum after another, which, on somebody's authority, will exert some miraculous influence over the solution; kept as made, it will require no further treatment beyond occasional filtration for removal of dust which may find its way there. The bath should always be covered by cloth cover when in use, by a wood cover, or by its "tight-top" when put aside. Keep the solution to a given quantity by addition from time to time of triple crystallized silver, 1 oz.; pure distilled water, 8 oz.; thereby maintaining measurement and strength at condition when first made.

A silver wire dipper is preferable to one of glass. Finely-chipped glass deposited at the bottom of the bath is an evil, and this is a necessary result with the glass-dipper. Another advantage in the case of the silver wire is the impossibility of a plate slipping from the dipper into the bath, with the consequent annoyance and loss of time in emptying out the solution before the lost plate can be recovered.

To immerse the collodionized plate lay it face upwards on the dipper, *the thick edge where the collodion has drained, to the top*, and with one steady downward motion lower into the solution without pause or hesitation. Neglect in this particular will cause a line or lines to appear across the plate at every point where a stoppage has taken place.

As soon as the plate has touched the bottom of the bath, carefully draw it up and down in the solution, repeating the operation till all appearance of greasiness has been removed; it should remain three minutes from the time of first immersion to withdrawal, and the temperature of the chamber in which manipulation takes place should never be less than 60° Fahr. To remove the plate raise the dipper to its full extent for a minute, so that the surface solution may drain into the bath; take the silvered plate by the corner it was held when collodionized, and which remains clear glass, and drain further on a pad of clean white bibulous paper kept handy and used for no other purpose; wipe the back of the plate with a small pad of blotting-paper, and having placed small pieces of the same material on each of the silver wires at the lower corners of the "wet" slide, close the same now ready for exposure. It is more than possible that in cloud work the plate may be in the slide some minutes before the sky composes to the taste of the operator; it is therefore advisable to resort to the "wet pad," two thicknesses of *stout white blotting boards* cut a trifle under the dimensions of the plate and moistened under the tap before collodionizing. By the time the plate has been placed in the slide, the pad will have lost any superfluous moisture which might contaminate the silvered surface. The pad laid on the back of the plate when the latter is in the slide will prevent the sensitive face from "oyster shell" markings induced by drying of the film.

Always wipe out the dark slide with a clean, damp, not wet, cloth before commencing operations, and treat the inside of the camera in a similar manner to remove all trace of dust from the

instrument. Care should be taken to leave out or open the focussing screen for a few moments, or condensation will ensue.

In producing cloud negatives the latent image is developed as follows: Fill to three parts of its contents, a wide-mouth Winchester quart, with iron protosulphate in crystals; add 1 oz. copper sulphate to prevent deposit of iron persulphate. Fill up the vessel with common water and shake at intervals during twenty-four hours, at the expiration of which time the solution will be completely saturated with iron. Keep this as stock, always half full with the crystals of iron and filled up with water; iron protosulphate, sat. sol., 2 oz.; glacial acetic acid, 1 oz.; water, 20 oz. Remove the plate from the dark slide, and holding it by the No. 3 corner before described, pour from a 4 oz. measure sufficient of the developer to cover with one unbroken wave of the solution, commencing to pour at corner 3, inclining the plate to corners 1 and 2, and carrying the measure to corner 4, pouring continually meanwhile. With very little practice proficiency in this manipulation will ensue, to the end that too much solution be not poured on to wash off the silver, thereby weakening the image.

Wherever the developer may stay in its flow, wherever a spot may be left uncovered, a mark will result which cannot afterwards be obliterated. A cloud negative will be quite a minute before it makes its appearance under development. It should come up extremely slow. As soon as the detail is fairly out—not too much of it, or a deposit will be formed over the shadows to the *ruin* of the picture—rinse under the tap, and intensify very carefully with pyrogallic acid, 3 grains; citric acid, 1 grain; water, 1 oz. Mix this as wanted, and add two or three drops of silver nitrate, 10 grains to the oz. Fix in sodium hyposulphate, 8 oz. to the pint of water.

When finished, cloud negatives by the wet process are brilliant in the lights, the deposit on the middle tones extremely thin, the shadows represented by perfectly clear glass. The advantages gained are in contrast, definition of form and lightness of printing. Too soft a sky gives a dirty muddy appearance to the print, the exquisite delicacy of the fleecy formation becomes merged in the surrounding tones, to the utter loss of the composition. The wet plate negative will rather exaggerate the contrast when judiciously developed. The printing from such a plate is rapid; two or three minutes in diffused light, and this quickly printed picture when toned and fixed gives precisely the effect desired in a perfect photograph of the sky—form, delicacy, brilliancy.

If by chance a cloud negative be taken with full deposit over the plate, no matter how beautiful may be its composition, it can be destroyed at once; prints from it will be slow to make and *solid* in appearance when finished. We require *thinness* in cloud negatives to correctly represent their light and airy beauty.

A HANDY CIRCULAR SAW-TABLE.

By W. S.

THE following details for an efficient and inexpensive circular saw-table for delicate work may be welcome to many readers of AMATEUR WORK.

First purchase an old sewing-machine table, the old type of table is the best, because it possesses three essential points—a heavy flywheel, a flat driving-wheel, and a good firm iron stand. The needle part is of no use, choose one without; it is worth about eight shillings, perhaps cheaper. Having purchased one, take it to pieces, clean it, relacquer and repolish if requisite.

To convert this into a circular saw-table, the following fittings are required, of which full particulars are given, as also measurements.

The circular saw, bobbin, and spindle, are shown in Fig. 1. Total length of spindle, $5\frac{1}{4}$ inches; bobbin, $1\frac{1}{2}$ inch. The saw is shown in plan in Fig. 1A. It should have very fine teeth; the best, to my mind, are made by Hill, 253, *Gray's Inn Road, King's Cross.*

The next step is to make the frame for the saw, shown in Fig. 2, the sides for which should be $1\frac{1}{4}$ inch thick, and dovetailed. A carpenter will make one in hard wood for a trifling sum, if the amateur is not sufficiently skilled to do the work for himself.

The flat driving-wheel, to put the saw in motion, requires a bobbin on the saw spindle for a strap. This should be made as shown in Fig. 3. Turn this bobbin out of ash, and drive it tight on the spindle.

The top of the saw frame is made in two pieces with a bevelled edge, as shown in Fig. 4. American walnut, $\frac{1}{4}$ inch thick, such as is used for fretwork, will do for the top, guides, etc. Mount your circular saw, then screw on the pieces, A and B, leaving sufficient space for the saw to work freely. The hole, C, must also be large enough for bobbin and strap. The little round holes in A, indicate the place for two thumb sash screws. The pieces, A and B, should project 2 inches in the front of the frame.

Two guides, as shown in Fig. 5, are now required on A. Cut the bobbin hole to correspond with C in top A, and, further, two slots wide enough for the thumb sash screws to work with ease.

On the side, B, a separate and movable slide is required about one inch wider than B. Cut two pieces

of brass, as shown in Fig. 6, which screw on at each end of the movable slide, D E, as shown in Fig. 7: these require to be flush with the wood — they act as guides on one side; then on the opposite side, underneath, screw a long strip of wood, 1 inch wide; before doing so, adjust it on B, and mark the place for the screw holes. This slide should move backwards and forwards freely, and without any side motion. Paste a piece of white paper from the front to the middle of the slide, on which draw a quadrant divided into 90. To

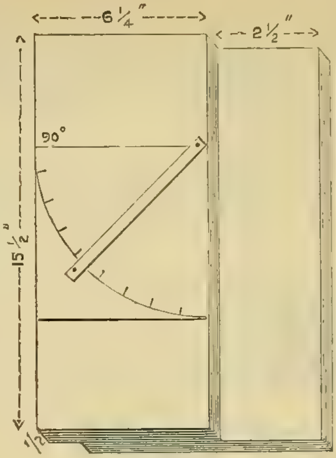


FIG 8

FIG 9

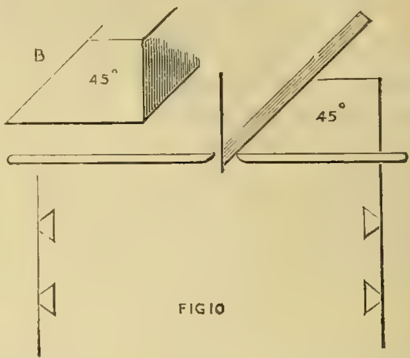


FIG 10

FIG. 8.—SHOOTING BOARD. FIG. 9.—BLOCK FOR CUTTING BEVEL—A, PERSPECTIVE VIEW FROM FRONT; B, END VIEW. FIG. 10.—MODE OF CUTTING BEVEL WITH SAW.

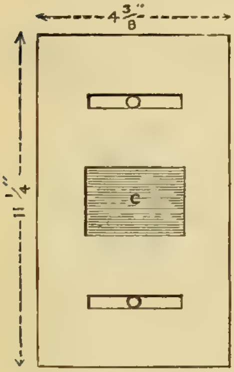


FIG 5

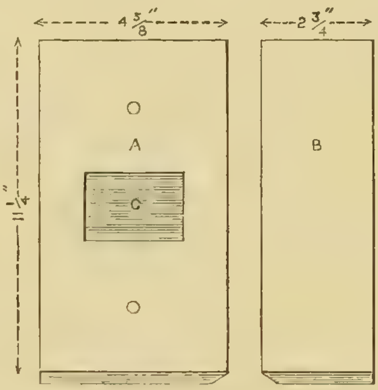


FIG 4

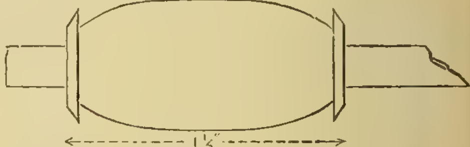


FIG 3


FIG 6

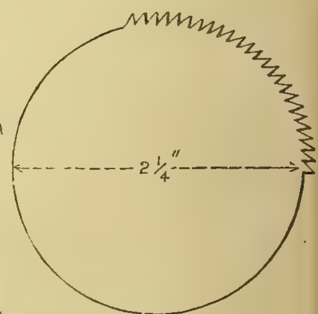


FIG. 1A

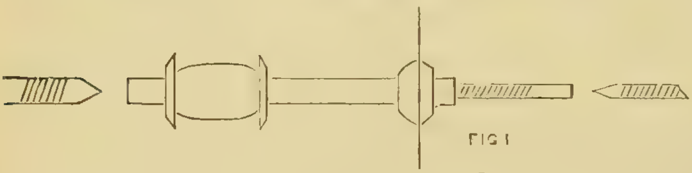


FIG 1

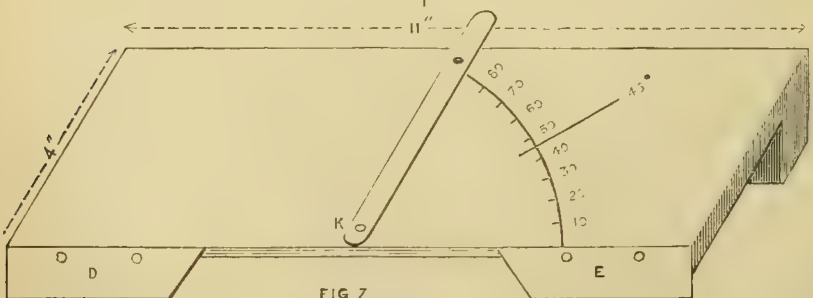


FIG 7

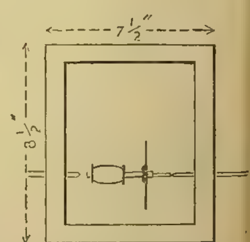


FIG 2

FIG. 1.—CIRCULAR SAW, BOBBIN, AND SPINDLE. FIG. 2.—FRAME FOR SAW. FIG. 3.—BOBBIN FOR SPINDLE. FIG. 4.—TOPS FOR SAW FRAME. FIG. 5.—WOOD GUIDE FOR TOP A IN FIG. 4. FIG. 6.—BRASS GUIDE FOR MOVABLE SLIDE. FIG. 7.—MOVABLE SLIDE WITH QUADRANT.

complete this slide, you only want a movable index made of a strip of hard wood, secured at K by a small screw. The guide must be so adjusted that when moved, it may correspond to lines of angles marked on the quadrant. The machine is now complete.

For long, straight strips, adjust the lower guide, A, to the width required, place veneer in position, and cut off in lengths of about 8 inches. To cut angles, etc., bring the lower guide, A, close up to the saw, but not to touch; this will bring it on the level with the movable slide, M. The top guide, A, then comes into play for adjusting size of angles, etc. Next place the index on the quadrant to the angle required, secure it by a small screw. Against the index place a strip of veneer, push the slide, M, gently forward against the saw in motion, and a corresponding angle will be cut off, to the one marked on the quadrant.

The circular saw, in cutting, leaves a burr. To remedy this, make a shooting board as per dimensions given in Fig. 8. About one-third from the top, paste on white cartridge paper, on which draw a quadrant, and divided in 90°. A movable index enables you to adjust to the angle required, then, with a sharp American plane trim up the edges. A close-fitting joint is thereby secured which enhances the value of the work when finished.

A further use of this circular saw-table is in the cutting of bevels for boxes, trays, etc., by simply cutting a block to the required angle, in which drill two holes at about $1\frac{1}{4}$ inch from each end, with corresponding holes in the top of the circular saw-frame. Two stout wire nails dropped in secures it firmly in position.

To make boxes, trays, etc., first cut $\frac{1}{4}$ inch American walnut in lengths of about 18 to 20 inches and $1\frac{1}{2}$ inches wide. Finish and polish as far as you can, it saves after labour. Having decided on the size of your box or tray, cut your lengths, etc., on the circular saw-table, placing your index at 90°. When ready, place the bevel block in position—the end to be bevelled is held as indicated in Fig. 10—and press gently towards the saw in motion.

These bevel blocks are easily made. Draw a quadrant, carefully divided, on paper, and cut out the angle required. The blocks must be made in hard wood by a carpenter, by simply giving him the angle cut out in paper, and dimensions as in Fig. 9.

This circular saw-table carefully made, will cost about 20s., and will prove a source of endless amusement and enjoyment. By this table you will be able to veneer and inlay tables as designed in Folding Sheet given in Vol. IV. of this magazine. The dimensions set forth in the preceding instructions are simply to guide the maker in his work. He may vary them to suit his own wishes or requirements.

PATTERN MAKING FOR AMATEURS.

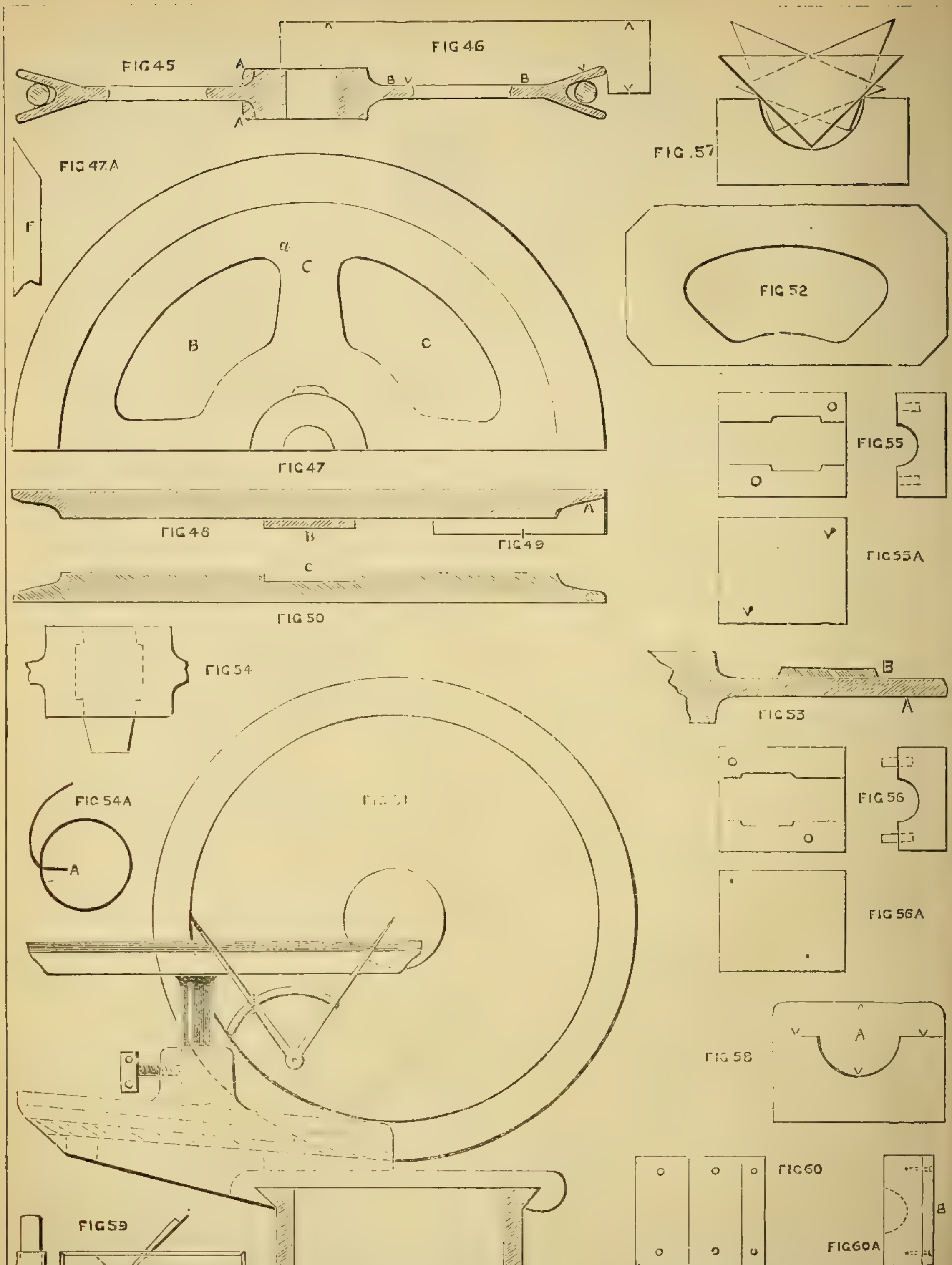
By ARTHUR J. SCOTT.

IV.—A FEW HANDY PULLEYS—ROPE AND BELT.

HAVING explained in my last article the meaning of cores in patterns, literal and practical, I shall now explain how to make a few of those little handy pulleys so much in use about an amateur's sanctum. In making the patterns for these small pulleys, the amateur will gain a better insight into the work, and will be enabled thereby to undertake more intricate jobs than these herewith explained.

To make the rope pulley (Fig. 45) the pattern will require to be in two parts, jointed along the centre of arms and groove in pulley, represented more clearly in Figs. 48 and 50, these two views show the appearance of pattern when the groove has been turned out; and now I will give the novice a little advice as regards turning. First and foremost, be steady; don't be trembling all over, and take a gouge or cutting-down tool in your hand whilst you are, for if you do, you will be sure to pay the penalty some way or another. Be satisfied for a time to hold your tools firmly on the rest; and in regard to chisels (flat or round nose), hold them steady, and let them rather, as I shall say, scrape than cut, keep all gouges, cutting-down tools, etc., extremely sharp, for these really are the acting cutting tools you will use. Now for a little painful incident, which may be of value to some I am writing for. Don't try, unless you are perfectly sure you can succeed, any fresh tips, as you may call them, in turning; for instance, a friend of mine in the same calling was one day watching some very clever professional turner, and saw a novel, though dangerous experiment: the man really had his gouge on the other side of centre with very little support, and was turning some very splendid work out. I dare say some others who may read this have also seen the same idea, but I have never attempted it as yet. To go on with my story: my friend comes back in high glee, and relates about the tip, as he calls it, and resolves the next job he has in the lathe he will attempt it; so he does, puts his gouge to the work, and receives the "tip," but this time the tip is an awful gash in his hand: so much for that. I am only relating this as it might possibly save some of my readers getting into the same predicament.

Wood turning in the pattern-shop is not, as a rule, very plentiful. I mean sufficient to enable him to compete with a professional, but, nevertheless, it enables a man to do a great amount of plain turning (and sometimes dangerous) well and accurate; the last named being, I must say, indispensable. There is not much (if any) practice in the higher branches of wood



For Description of Figures see opposite Page.

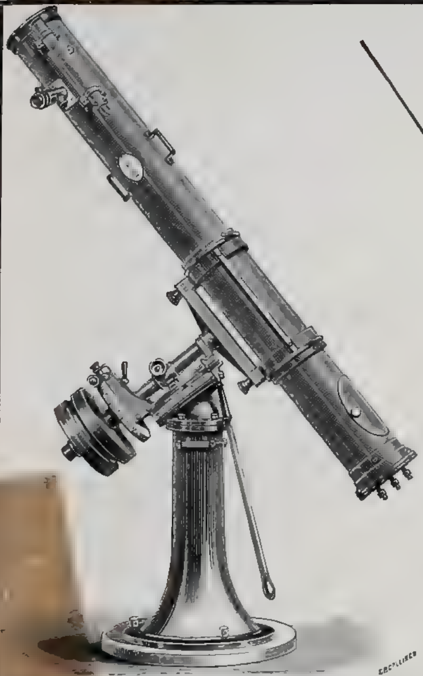


FIG. 108.

View of Reflecting Telescope, mounted on pillar, shewing mechanism of mounting.

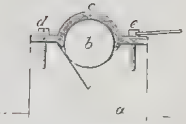


FIG. 110.

Section of Declination Axis Bearings—
shewing A, Casting D in Fig. 108;
B, Declination Axis, E Fig. 108;
C, Gun-metal or Brass Collar;
D, Screw; E, Adjustable Screw
to regulate pressure of Collar
on Shaft

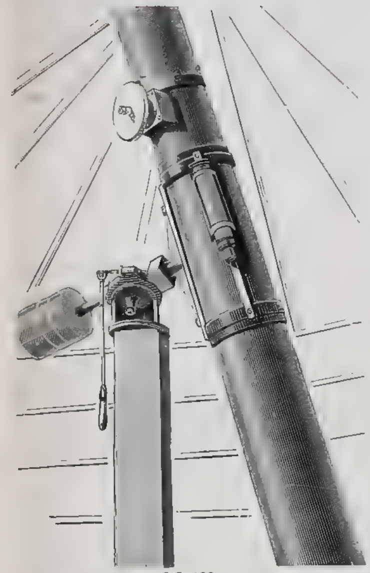


FIG. 109.

Sketch, shewing Complete Tube when mounted.

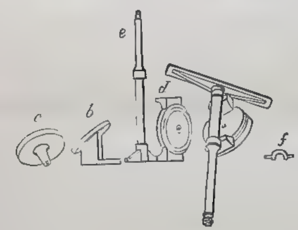


FIG. 107.

Various Parts, shewn in Fig 108.

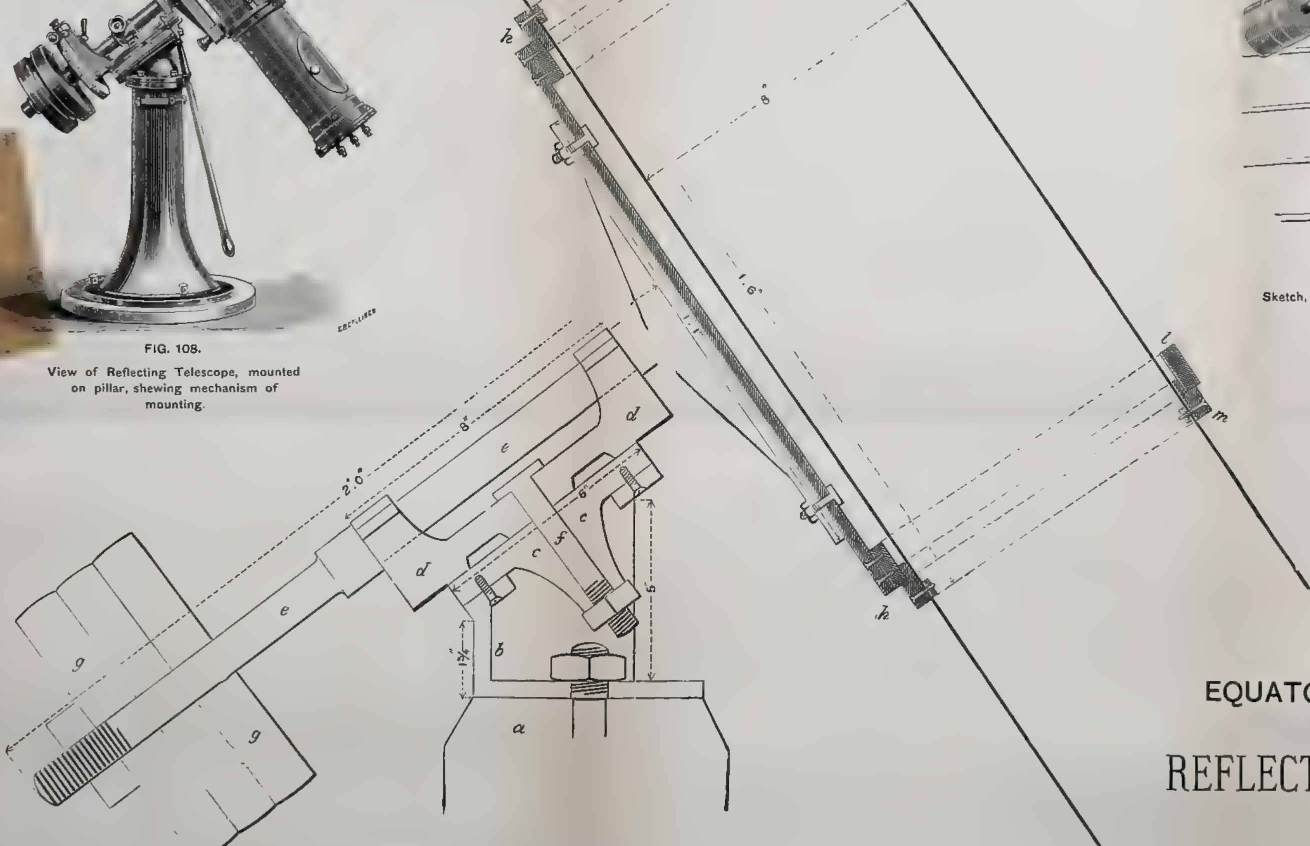
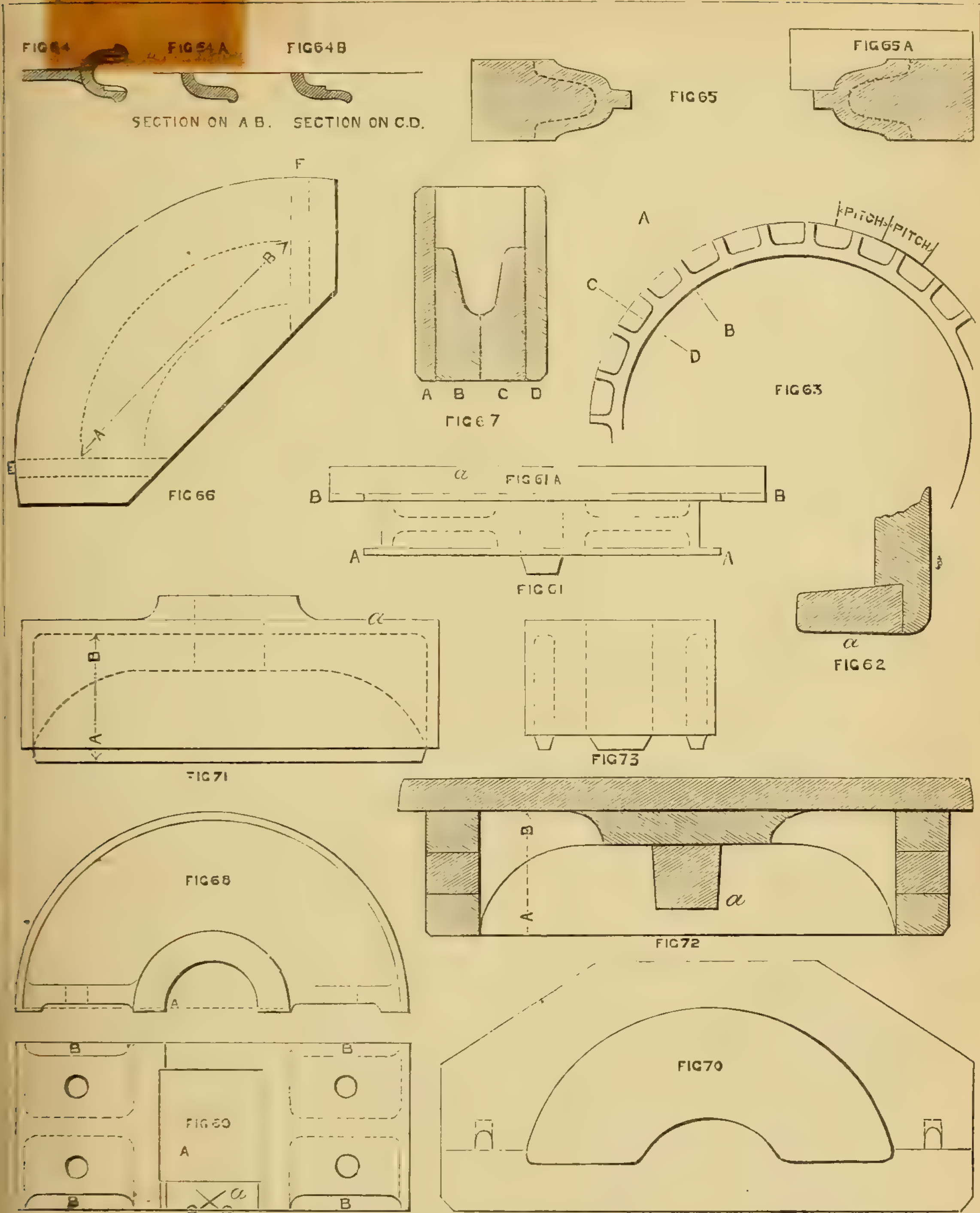


FIG. 106—Stand for mounting Reflecting Telescope, exhibited in sections

EQUATORIAL MOUNTING

FOR A

REFLECTING TELESCOPE



FIGS. 45—50.—DIFFERENT VIEWS OF A SMALL ROPE PULLEY WITH ONE GROOVE. FIG. 51.—EXAMPLE OF SETTING ON DIAMETER WITH COMPASSES IN LATHE. FIGS. 52—60A.—VIEWS OF DETAILS OF PULLEY.—FIGS. 61, 62.—TWO VIEWS OF DOUBLE FLANGE BELT PULLEY. FIGS. 63—64B.—CHAIN PULLEY, THREE VIEWS. FIGS. 65—67.—THREE VIEWS OF CORING-OUT GROOVE IN ROPE PULLEY. FIGS. 68—70.—DIAGRAMS OF A SMALL STRAP PULLEY. FIGS. 71—73.—OCCASIONAL PULLEYS.

turning, but still there is enough scope to make the pattern maker an adept at the lathe, and, if he is a little longer time over it, his work will compare with any professional turner.

To return to Figs. 48 and 50, representing two different sections of Fig. 45, showing the rope groove turned out. To turn the groove true to shape wanted you will want a templet, shown in Fig. 49, and the manner of using. This is a strip of wood about three-eighths of an inch in thickness, cut exactly to the form of Fig. 49, the part marked A rubbed with chalk or heelball, so as to show on the pattern whether it fits it all over or not. The pattern being in halves, requires something to keep it true during moulding; this you must do by making male and female halves; B in Fig. 48 showing the male half of pattern, representing a facing turned on the joint about three-eighths of an inch thick, the diameter varying according to size of pulley. This facing must be a tight fit (yet not so tight as to bind itself) into the recess, C, turned in Fig. 50, and if a continuous plain plate around the boss, will not need anything more, but if the centre plate is made as shown in Fig. 47, cut into arms, then you will require a dowel, shown at A, Fig. 47, to keep it in its exact position during moulding. To turn the outside, you will require a templet, made of the form of Fig. 46, cut exactly same shape, for if you do not get your templet right nothing that you turn from it will be correct; for instance, in making a machine, such as a lathe or planing-machine, if they are not made correct and true, you cannot as a matter of form expect anything made from them true, for wheresoever their defect is, the job done on them will be magnified accordingly. To turn the outsides, you will require to chuck each separate half, chucking Fig. 50 first, or a better plan would be, while Fig. 48 is fast on the face-plate, to fasten with screws Fig. 50 to it at the parts you won't have to touch with your turning tools, and turn that outside, using the templet before mentioned as a guide.

In Fig. 51 you have a view showing how to use your compasses in lathe, set at their respective diameters, which will be a very good guide for roughing out. The tools you will require for this job are a gouge, a round nose, and a flat chisel, which must not be ground to an obtuse angle, or you will find it digging in when not wanted during turning up an angle somewhat like Fig. 47, a try; you will soon get to know what amount to put in. The gouge you will do all the roughing with, and the flat chisel and round nose you must finish the pattern with, by using your own discretion over these simple matters.

We will now suppose our pattern turned, and the dowel A shown in Fig. 47 fastened in its place. If you are going to cut a keyway in, you will want keyway pieces, fastening outside boxes as shown at A, Fig. 46; these will compensate for the metal cut away for the key. In regard to the portions cut away at B and C, Fig. 47, for the arms, this can either be done by a core box or cut out of the pattern; if you wish the corners rounded as at B, Fig. 46, you will require to cut the holes out of pattern, if not, you may core them by making four prints same shape and size of hole, about $\frac{1}{4}$ inch or $\frac{3}{8}$ inch in thickness, shown more clearly in Fig. 53, A showing the plate, and B the print; you will also want a core box as in Fig. 52, the thickness of print and plate combined. In regard to the boss part, sometimes they are wanted chambered so as to save boring, as in Fig. 54. I will suppose, in this case, it is so, as if not it would only simplify the matter. In Figs. 55 to 60, I give a series of views, showing how to make a core box for the centre; if you wish to have a straight core put in, you will have no need to go to the trouble of making a box as every foundry has standard core boxes, and will save you the trouble; but following it up that you want a chambered core, you will want a box in two halves, as in Figs. 55 and 56, dowelled together. You firstly work the box straight through the smallest diameter, then gauge lines the width of chamber, afterwards working the rest out with your carving gouges and chisels; before doing this, however, I will explain a point which might have puzzled some of my readers, which is, how to get the centres of dowels to coincide with each other in each separate piece. There is a way most certainly of setting the centres out by squaring lines and intersecting; but I intend to show our amateur a more ready way for which he must prepare himself with a pair of pins or small leaden pellets, let him on one half arrange these in position then drop the other half box over them, and press on the top with some weight; turn over and you have the halves, as in Figs. 55*a* and 56*a*, the centre marked in each piece for the dowels. To work these boxes true, you will require templets, as shown in Fig. 58 at A, or a more rough and ready way is shown in Fig. 57 by means of an ordinary set square, you will notice the right angle will touch all round the circle; a handy plane for working these boxes is shown in Fig. 59. I have in former articles explained sufficient on tool making, to enable the amateur to make one of these for himself; to these I must now refer him, merely stating that an angle of 50° I find to be the best for the purpose described. To finish the box, you will require a rubber, as at Fig. 54*a*, turned a little less in diameter than the box, so as to allow for the sand-paper, A being a slot sawn up the rubber to keep the paper in position.

In Figs. 61 and 62 I give two views of a handy belt pulley with a flange cast on either edge; a complete view is shown in Fig. 61. To make it, if it is

not required very deep over the flanges, it can be turned out of a solid piece, except the loose flange A, shown more clearly in Fig. 62; it would be better to turn this ring the first, then you can turn the full pattern to suit for diameters. We will take the other case, supposing it to be pretty deep over the flanges, you would best, in that case, get a piece of wood the diameter and the thickness of plate, and build up the rim on it, made from segments glued and nailed into place; for the boss you will need no building in that case as an ordinary round piece glued and screwed is the best. To chuck work of this description, and to turn up the opposite side, a good plan is shown in Fig. 61*a* by four loose pieces being fastened on face-plate A, and turned on their inside edge so as to form a recess to drop the pattern into, which can then be secured firmly and true.

In Figs. 63 and 64 we have some views of a chain pulley, the centres on Fig. 63 marked pitch, representing the pitch of link in the chain. The method of making is precisely similar to Fig. 45, excepting the alternate recesses for the chain. To make it—turn the pattern groove like Figs. 64 and 64*a*, afterwards set out and pare the alternate recesses out with carving tools, and afterwards finishing with glass-paper. You must not forget in this case, with the groove being alternately recessed, that you will require in the plate-joint an additional dowel to prevent one half shifting out of its position with the other; and in your setting out you will require the groove very accurately set out; if not, your chain won't coincide in the same ratio. To work the recessed portion, get a small cranked gouge of small sweep, and work down within the lines, taking out to depth required; then take off lump in centre with a paring-chisel.

In Figs. 65 to 67 we have three views of rope pulley whose groove requires coring out. We first of all build up a rim with segments, and turn to section shown in Fig. 65, making templet for turning as at Fig. 65*a*. The method adopted of building up will be described in detail later on. We next want a core box whose *exact* distance from A to B must make equal distance all round the circumference of the circle, no matter how many times it may divide it, the one shown representing a fourth. According to the number of divisions in the circumference is the number of cores, and *vice versa;* so that when the number of cores has been made and dried, they being laid round the mould shall make a complete circle, unbroken in any part. To make the box we will refer to Fig. 67, A and D showing the sides of box, B and C the two pieces of wood which make up the groove. Joint these together, and after working the ends to the correct angles at A and B, Fig. 66, set out the groove on end, take to pieces, and work to templet after the same fashion as shown in Fig. 49. After working groove fasten on one of the sides and screw the ends E and F in position, afterwards closing up box by fastening the last side on which will finish core box.

In Figs. 60 and 60*a*, I show two views of core boxes hitherto spoken of in connection with rope pulley at Fig. 45, to enable those amateurs who are not so well up in woodworking the simplest methods they can make the box. It is made out of three thicknesses, as shown in Fig. 60, paring each piece separately, afterwards fastening a bottom piece on as at B, Fig. 60*a*, to hold them all together.

Now to pass on to a very handy strap pulley, shown at Figs. 68, 69, 70. We make this pattern out of a solid piece, carrying the centre a little in to allow for facing, as shown at A, Fig. 68, the centre hole you may cut out if not chambered straight through. If so, you will require one of the facings loose, secured by screws as shown at A, Fig. 69. You will perceive the bolting flange is recessed down from boss to rim, as shown at B, Fig. 69; this will require cutting out in pattern. You will now want a core box of the form of Fig. 70, made in two halves dowelled together, the depth of box, being from midrib to outside of rim plus thickness of print; the holes are shown in the bolting flange, but they are really drilled.

In Figs. 71 and 72 we have two views of a plate pulley whose plate A, in Fig. 71, is level at one of the edges of rim. To make this it will be at once obvious that it would be very foolish to make a wooden pattern like casting; the better plan would be to make a core box like Fig. 72, built up out of segments as shown in section—A showing print for centre core, the distance from A to B in Fig. 71 and 72 being equal in both cases. In Fig. 73 we have a view of pulley which would be very awkward to leave its own core at A, so we make a core box in halves for this, along with a centre core, and then we obtain a casting the section what we require.

(*To be continued.*)

THE REFLECTING TELESCOPE:
ITS CONSTRUCTION AND MANUFACTURE.

By EDWARD A. FRANCIS.

XV.—THE CORRECTION OF ERRORS IN THE COMPLETED SPECULUM—MOUNTING THE INSTRUMENT EQUATORIALLY—CONCLUSION.

(*For Figs.* 106—110, *see Folding Sheet issued with this Part.*)

ASSUMING that the speculum performs improperly, we have now to discover where the figure of it is at fault. Three shapes of cardboard, or sheet zinc, Figs. 101, 102 and 103, should be prepared. The dotted line in those figures indicates the size of the

speculum; the solid ring and disc the shapes above referred to.

The reader will remember that in a perfectly-made telescope, the rays reflected from the central portion of the mirror surface are exactly as long as those reflected from the other part, so that all the reflected rays come to a focus at one position. Now it will be seen that if Fig. 101 be placed centrally on the speculum, any error peculiar to the part of reflecting surface so covered will cease to be noticeable in the focal image. So with Figs. 102 and 103. If the image is examined through the eye-piece, using the whole reflecting surface, and the best position of the eye-piece ascertained, and then, when Fig. 101 is so placed as to cut off the central rays, it is found necessary to push the eye-piece inwards to get the best image, it will be evident (see Fig. 54) that the central rays are too long; and the curve of the mirror must be a little, very little-deepened to correct this fault: its figure is that of an oblate-spheroid. Or if, on the contrary, the eye-piece has to be pulled out, it shows that the speculum has a hyperbolic figure—outer rays longer than inner (Fig. 58, etc.), and the treatment indicated on page 403, Vol. V., must be applied.

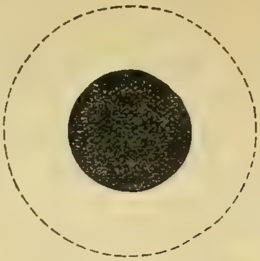


FIG 101

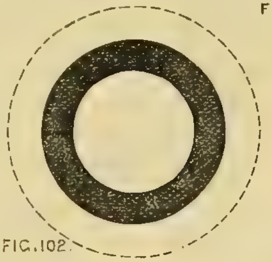


FIG. 102

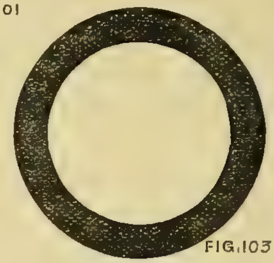


FIG. 103

FIGS. 101, 102, 103.—DISCS TO RECTIFY FAULTS IN SPECULUM.

We have assumed that the definition is very bad; if it is fair—that is, if the image is at all steady, and not working like a tiny white chromatrope—let it alone. Begin another speculum of the same size, and test one against the other, working on carefully until perfection of figure is reached.

It will be seen that when the eye-piece is moved either way, so as to throw the image out of focus, the light disc expands, and a tiny black centre is seen; this black centre is the result of having to use the little flat mirror, but the size of the disc may be used for testing purposes. The eye-tube may be set at the best focus, and its position marked by a line scratched around it. It may then be pushed inwards until the expanded disc is of a certain size—determined, let us say, by a thread stretched over the eye-piece field out of centre. It can be easily seen when the margin of the light disc touches this thread. When it does so, mark the tube a second time. Then pull the tube right out again—past the point of best definition, until the enlarged disc outside the focus touches the thread—when its position should be a third time marked. If the speculum is truly figured, the centre line should be equidistant from the other two. If this is not so a small diagram of imaginary ray paths will soon indicate the reason.

Again, if the dark centre is only visible when the eye-piece is pulled *out*, but is replaced by a bright centre spot when the eye-piece is pushed *inwards*—the mirror is of elliptic section. (See Chapter IX.). The reverse appearance indicates the hyperbola.

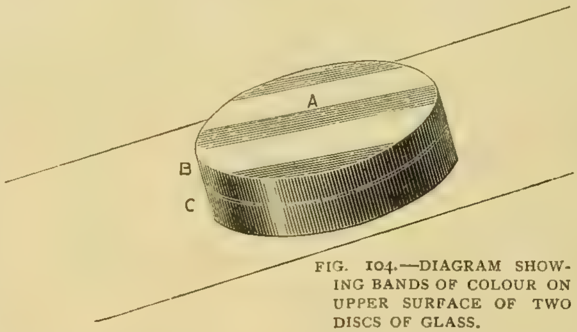


FIG. 104.—DIAGRAM SHOWING BANDS OF COLOUR ON UPPER SURFACE OF TWO DISCS OF GLASS.

It will thus be seen that there are several ways by which the shadow test reading may be confirmed, let not therefore a speculum be hastily judged or hastily altered.

Next to form a perfect "flat" or smaller mirror. In the trade method, three heavy discs of cast iron are turned and faced upon a self-acting lathe, and then ground together alternately, until any error of surface is corrected. The amateur may substitute three discs of stout plate-glass. They should be 4 inches in diameter, and at least $\frac{3}{4}$ inch thick. Edge them on lathe, or have them trimmed by glass-grinder. Let them be called A, B, and C. Work one upon the other alternately with fine flour emery; that is, A should be worked over C, C over B, B over A, until

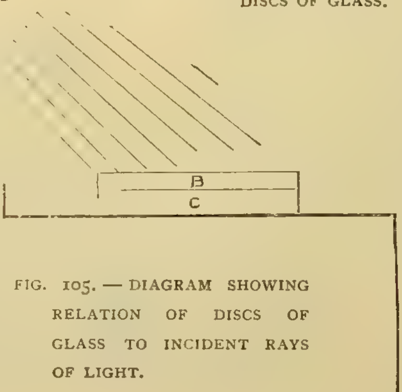
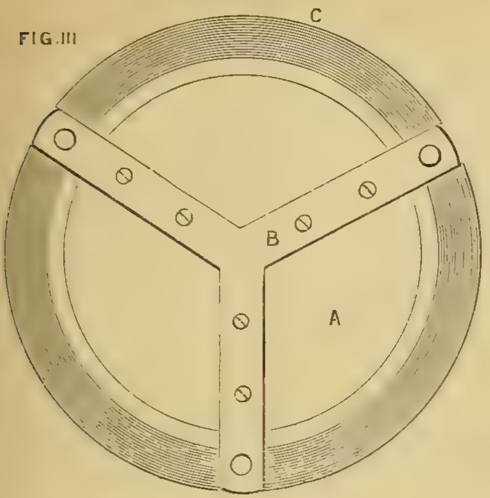


FIG. 105. — DIAGRAM SHOWING RELATION OF DISCS OF GLASS TO INCIDENT RAYS OF LIGHT.



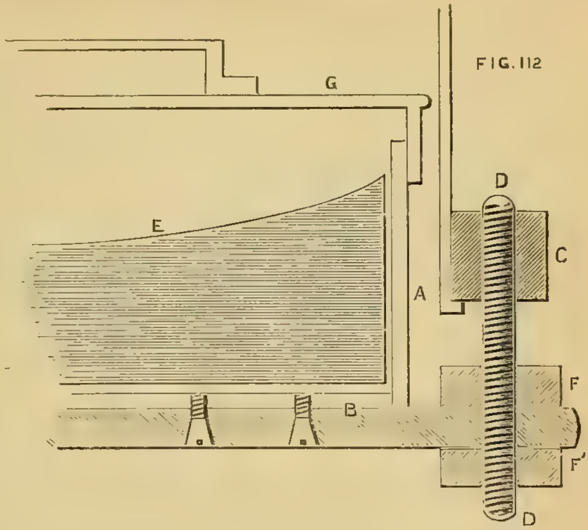


FIG. 111.—BACK VIEW OF MIRROR CELL—A, Mirror Cell; B, Forging to connect it with C, which is a ring at bottom of Telescope Tube. FIG. 112.—ARRANGEMENT FOR ADJUSTING MIRROR CELL AND SPECULUM—A, Mirror Cell; B, Three-armed Forging (see Fig. 111); C, Ring at End of Telescope Tube; D, Threaded Rod or Screw; E, Speculum in Cell; F, F', Nuts working on D; G, Cover for Speculum Cell.

the polish is quite removed. The greatest care must be observed in the stroke, so as not to form a curved surface. This may evidently be avoided by taking care to have no given disc face upwards twice in succession during the working. Obtain next a carefully edged piece of $\frac{1}{4}$ inch plate-glass 3 inches in diameter. With flour emery, work this on A, B, and C in succession, on each for a very short time, and then repeat the first process of grinding A, B, and C together. Continue working the flat on the discs, and the discs on each other until the polish is off the glass selected for the flat. Then proceed with like care to "fine" it

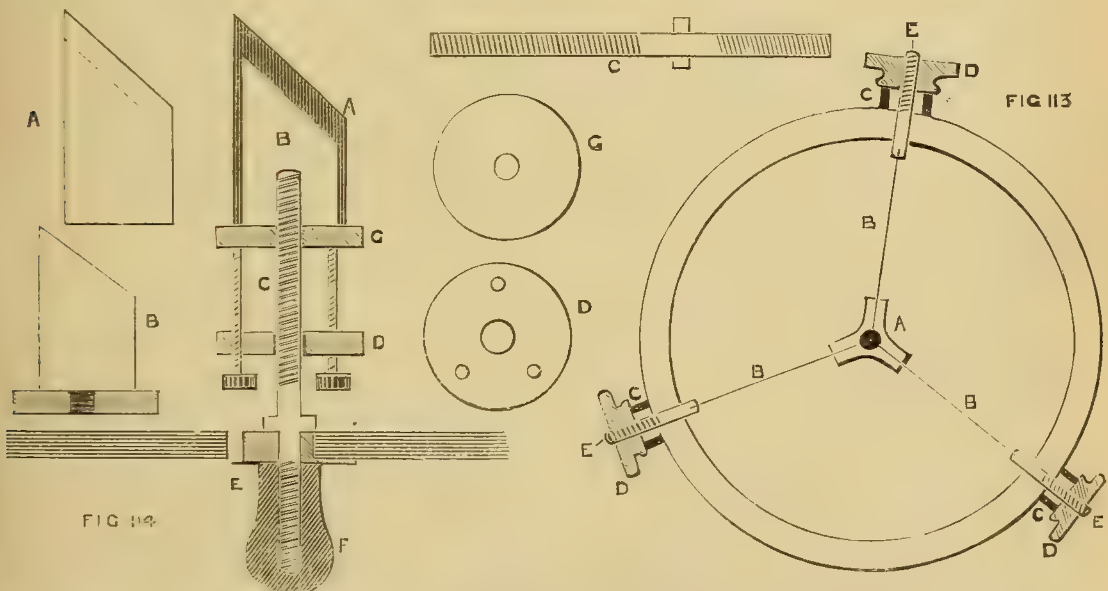


FIG. 113.—THE SUPPORT FOR FLAT MOUNT—A, Brass Centre Piece, about $\frac{1}{2}$ inch thick; B, B, B, Steel Band; C, Short Length ($\frac{1}{2}$ inch), of Brass Tube; D, Nut with Milled Edge working on E, Squared Rod, with Screw Thread cut on end. FIG. 114.—FLAT MOUNT—A, Outer Tube to take Flat; B, Inner Tube or Wooden Block to hold Flat in Position; C, Screwed Rod, fitting tightly into G, and loosely into D, a Metal Disc pierced for three Milled Head Screws; E, see A, Fig. 113; F, Leaden Counterpoise screwing down Rod, C, and fastening whole Mount rigidly to Brass Centre, E; G, Brass Disc drilled and tapped for E, and carrying the Inner Tube, B.

(see Chapter VI.) Lastly, make up a polisher of $\frac{1}{4}$ inch pitch on disc A. The pitch must be perfectly uniform in thickness and rather hard: the addition of resin securing the latter condition; the pitch surface being levelled by the aid of discs B and C. The small mirror should be polished with rouge for a very short time, when the polishing surface may again be levelled with B and C, and a little more polishing done. No pressure or damp, other than is absolutely necessary, should be used; and, of course, the polisher should be faceted. By this means, a good optically flat surface may be obtained. The faceting of the polisher may be conveniently performed by the edge of a steel "rule."

The flat, when complete, is cut out from the centre of the selected glass, by the means described in Chapter XII.

Of course, if the great speculum is perfect, the best test of all is to put the flat in the telescope and try it; but in any case the amateur is advised at least to construct three flats, for a reason now to be shown.

If two optically flat surfaces of transparent glass be placed one upon the other, as in Fig. 104, and there is no dust between the adjacent surfaces, broad bands of colour will appear projected upon the upper surface, A, as indicated by the shading in Fig. 104. By means of this colour flat surfaces are tested, and three at least should be made to secure accuracy, for it is evident that if B were just so much concave as C were convex, the coloured bands would still appear; for, without entering into the theory of the presence of these faint bands of colour, we may state for the guidance of the experimenter that their appearance depends upon the thickness of the air film between the glass surfaces. If this film is uniform in thickness, then it is evident the glasses must be flat, optically, and in that case the colour would either be uniform or in parallel bands. If, however, by reason of irregular working, the bands appear broken up, like the marbling on the edges of an account book, the film of air is proved to be of varying thickness and the flat imperfect. Great care must be observed in placing the polished surfaces together. The method of procedure shall be detailed.

Having worked the surfaces of the selected glass as accurately as possible, cut from out the centre of each a rough circle, slightly larger than the major diameter of the flat, say $2\frac{1}{2}$ inches; remove every visible speck of dust from the discs, and slightly polish the prepared surfaces with a fine chamois leather. Take then one in either hand, and holding them opposite to each other, about an inch apart, blow swiftly between the surfaces, and very soon place them together. Any lingering speck of dust will thus be removed. The joined discs should then be held or placed so that they will have the same relation to incident light and the eye as that indicated in the sketch, Fig. 105. To see the bands perfectly, the eye need not be very far away, but should be almost in the same plane with the upper surface of the upper glass, which surface the experimenter should look along. If nothing can be at first seen, the glasses may be pressed slightly together, but should the fingers be used, the heat consequent should be allowed to pass away from the glass before the testing is decided. The eye, of course, should be moved slightly to ascertain the best position.

This test is somewhat difficult until the colour is once seen, when all difficulty vanishes. The principle involved is the same as that by which "Newton's rings" are seen, and the latter experiment is described in most test-books on optics. A number of flats should be worked until one good one is secured. Do not attempt to re-work a bad one.

We have lastly to consider the mounting. In this matter it is proposed to direct the amateur in the general construction of a stand, rather than to enter into the mechanical details of metal turning. If the reader be an experienced metal turner, he can satisfactorily construct patterns for a stand from the designs herewith given; but the ordinary amateur will find it more economical to have the metal work properly fitted by an engineer. The cost of such a stand as that shown in Fig. 106 should be not more than fifty shillings. One other method of action is open, and that is for the reader to carefully study the principle of Fig. 106, and then construct a stand after a similar pattern from hard wood and metal.

The only perfect stand for a reflector of any size is an equatorial stand. If an ordinary turntable were placed in the open, and the telescope were to be fastened upon it, the latter could be swung round so as to sweep the horizon, and the pivot upon which it moved would point straight overhead.

Now the Polar or North Star is well known. Imagine your turntable tilted until the pivot of it pointed to the pole star, then the telescope when swung round would sweep always the equator of the heavens, an imaginary line dividing the northern and southern celestial-hemispheres. The stand (formed of the turntable) would then be an equatorial stand. Let us apply this to Fig. 106, which is an enlarged and simplified section of the mechanism of Figs. 108 and 109. The pillar A forms a base to which the mechanism is bolted. The casting, D, is the turntable referred to, which, it will be seen, is tilted so that the bolt or pivot, F, points to the pole star. This pivot is called the polar axis. The other axis, E, known as the declination axis, is a long shaft working in sockets cast in D at right angles with the polar axis.

The use of the instrument is as follows :—Owing to the movement of the earth all the stars appear to move in great circles, having the pole star as a centre, and they never move out from those circles. Now by means of the declination axis, the telescope is pointed until it is on the circle in which any given star moves ; and then, by means of the turntable, D, the whole apparatus is turned until the star is in the field. Evidently, all that is necessary afterwards to keep it in the field is to move the mechanism round on the turntable just so fast as the star appears to move. If this proves difficult to understand, read up the apparent movements of the stars in any astronomical book.

Fig. 107 displays the various parts of Fig. 106 ; and Fig. 110 shows the method of securing the declination axis. The casting, B, is hollow and almost tubular, see Fig. 109.

The angle which the turntable, D, should make with the level of the supporting column, A, depends upon the latitude of the place of observation—the polar axis being elevated to that latitude. For example, the latitude of London is 51½°, then the angle which the bolt, F, makes with the base, A, must be 51½°; but the actual measurement given will be found satisfactory. Some dimensions are stated from which the others may be worked out. The counterpoise weights, G, may be of lead or iron ; they will require in our case to weigh at least forty or fifty pounds.

The turntable in Figs. 108 and 109 is cut round its edge to an endless screw, and actuated by a worm worked by the handle shown. This refinement, although very desirable, is not indispensable.

The cradle carries the body tube ; it is shown in Fig. 106. The tube of the telescope is fastened by tiny bolts to the ring, M, which are recessed in the lathe and move smoothly upon the rings, L. The latter are fastened to a bar of wrought iron, H, which is in turn bolted to the declination axis flange as shown. The cradle will not come in centre of tube, but nearer to the bottom (see Fig. 108), for the tube must be balanced.

The telescope tube may be formed of very stout zinc, and should be at least one inch greater in diameter than the speculum cell. The completed tube is well shown in Fig. 109, except the mirror cell, which we will now describe.

The cell may be of iron or brass, made just to fit the speculum. It is secured to a forging of the shape shown in Fig. 111, which is a back view of the cell. A stout ring of brass or iron is bolted to the lower end of the telescope tube. It is shown in section at C, Fig. 112. This ring carries at three equidistant points ¼ inch screws, one of which is seen at D. Each screw carries two nuts, F and F F. Between these nuts the forging is supported, and by their aid the mirror cell, and, consequently, the speculum also, is properly adjusted thus : The first nut, F, being screwed right up, the forging is slipped on, being supported by the second nut, F F. The position of the latter may be varied until adjustment is secured, when the nut, F, being brought down, renders the whole secure, and prevents the state of adjustment being destroyed. Of course, as before stated, as there are three arms to the casting, there must be three tapped holes in the ring, and three sets of screws and nuts.

The flat mount has last of all to be illustrated. It is shown in Figs. 116 and 117. It will be seen that the one arm is no longer used, but that the mounting is supported on three stretched arms of steel spring. As these are stretched edgewise to the incident light rays, very little light is cut off.

Fig. 113 is self-explanatory. The ring shown is the ring immediately over the eye-piece in Fig. 109. The holes in the ring and the brass end-pieces to the steel spring, are squared to prevent twisting during the process of adjustment by the screws.

Fig. 114 gives a general view of the method of mounting the flat. A full description is appended, but it should be noted that the flat is adjusted by two movements. The one is the tilting of it in any desired direction by the screws in the disc, D, which work through tapped holes in that disc press on the other disc, G ; the other movement is around the rod, C, as an axis. It will be evident that the whole mechanism can be detached from the telescope tube by simply unscrewing the counterpoise, F, and sliding the rod, C, and all it carries, out of the central hole in A, Fig. 113. For further general details of material, etc., see Chapter XII.

With the mounting of the finder, the particulars of which were previously given, the telescope is completed, and the intention of the writer is accomplished.

It remains but to state that Fig. 109 is a photograph of a perfect instrument under an observatory, the whole of which, with the exception of the metal turning and the eye-piece lenses, was constructed by the writer, in whose workshop the professional optician, or brass-worker, or carpenter, has never yet entered.

Those of my readers who have followed me throughout, and who are still working or interested, may consider my experience and advice entirely at their service, either to direct them where to procure material, or how to proceed if they are at a standstill in the mazes of the finer working, or what books to refer to for a more complete knowledge of the subject.

For test objects, and general directions as to the use of the instrument, the best book for the amateur

to obtain is "Half Hours with the Telescope," by R. A. Proctor. The catalogue of one of our greatest speculum makers, namely, that of Mr. G. Calver, *Hill House, Widford, Chelmsfvrd*, may also be purchased with advantage. Its cost is 1s.; or a similar work, originally issued by Mr. Thornwaite, can be obtained from Mr. E. G. Wood, of *Cheapside.*

(*Concluded.*)

HOW IT WAS MANAGED.

A SERIES OF PRACTICAL HINTS, SUGGESTIONS, AND WRINKLES.

FROM AMATEURS FOR AMATEURS.

XXXII.—MY OWN ELECTRIC ALARUM.

[*From HARE'S FOOT.*]

IN presenting another alarum to the readers of AMATEUR WORK, it is not, I hope, too much of a sameness. In making it, as will be seen from the sketch, the merest amateur may hope to be entirely successful.

It has also, it may be said, just the appearance of an ordinary clock, as there is no disfigurement of dial, the line wires being all to tell that it is an alarum, the wood holding the disc and the connection-rod seems only to be a bell; the connection-rod is not seen when not in use. I bought a small clock, which cost me 5s. 3d., but would cost 7s. 6d. retail; a Leclanché medium battery at 3s. 6d., the price of which would be 5s. 6d.; an electric bell at 8s., small wire, gutta-percha-covered, at a penny a yard; these being bought I proceeded to fix it up. I turned a piece of hardwood to put in the right-hand corner of clock-case, and a metal disc to cover the face of the wood, which must lie close to the case, and almost in the opposite place of a bell in an ordinary alarum clock; the wood, shaped like Fig. 2. Fig. 3 gives the metal disc, which just covers the wood; the wood, I may say, is fixed to the back of clock-case by two screws, Fig. 6. The disc is also fixed with two screws, the holes of which will be seen on referring to Fig. 3; you will also notice a centre hole, making three holes, this is to receive the terminal Fig. 4, which is riveted to back of disc, so that it will revolve, care being taken that it does not do so too freely; also, run a small groove down the back of disc half-way, which holds the wire when the disc is screwed to the wood, making a connection without solder or a terminal for wire. Fig. 5 shows the connecting-rod coming from the terminal of the disc to the face of the clock, where it lies so that the minute hand will clear it, the hour hand making the connection. These being made, you will now proceed to fix it up. Screw the turned wood to the back of clock-case in the right-hand corner, bore two holes in top of case for the wires, now put in its place (mine is on an overmantel in a bed-room), then fix your bell to the head of bed, keeping it in the centre, and not too low down. The disc I silver-plated, and gilt the terminal and round-headed screws, also the connection-rod, Fig. 5, which is round wire to fit hole of terminal, which allows of its being shifted up or down; the terminal, as seen, revolves, allowing it to be moved to the part of the dial where you want it to ring, which it will do till you rise and stop it, by lifting it over the hour hand, when it lies up the side of case, not being seen when the door is shut.

I may, if the terminal is stiff, stop the hour hand but not the clock. The terminal may be just slack enough for the hand to move it without stopping the hour hand, when it will ring until it has freed itself, which it will do as the hand moves in a circle. Now take the wire and coil of small spiral round a spindle or piece of wood, leaving a straight piece to come down the right-hand hole in top of case, previously bored. Fig. 1 shows spirals and wire going through case. Strip and scrape the straight end of wire, which should come half-way down the wooden block already screwed to case. Take the disc with the terminal riveted on and screw it tight to the wood, thus clamping the scraped wire to it. Bend the wire for connecting the face of clock and terminal, Fig. 5, so that it will ring at the time you want it to alarm. When you have it adjusted, screw the male screw down on it, shift it to the side of case, and close the door. Now lead the wire with the spiral at the clock to the left-hand terminal of bell, where fix by turning up a loop. Cut the wire and scrape the loop and screw it down, now lead a wire from the right-hand terminal of bell to the left-hand one of battery, another wire from the right-hand one of battery to left-hand of clock, to fix which take off dial of clock, and you will see that it is fastened by four screws, unscrew the left-hand one at the top, loop the end of your wire and scrape as before, then screw the clock and wire to case, keeping the wire between the screw and movement. You have an alarum easily put together, and that will ring without stopping the clock, although it may the hour hand if the terminal is too stiff. The line wires are held straight by small staples, Fig. 7, as seen across the lines.

Mine has been in use for years, and many of my friends have had them fitted up for themselves, and have found them to answer admirably the purpose for which "My Own Electric Alarum" is intended.

XXXIII.—MY OWN HELIOGRAPH.

[*From W. S. M.*]

HAVING originally written to you on the subject of Heliographs for Amateurs, I send an account of how I made one, to be used from windows. Having obtained a round glass and made a hole in the centre of the back, I cut out of a plank a U frame, and hung the glass in it. I then turned two pieces of oak to fit accurately, the one, B, Fig. 1, into the other, A; and let the U frame into A at X, this requires care so that it should be perfectly square and upright. I screwed B on to a platform (C, Fig. 1) obtained from the wood cut out of the U, so that it should turn stiffly. Then made a sight arm (B, Fig. 2) of three slips, having at the end a white cardboard sight (E, Fig. 5), and let it in flush

into the top of B in continuation of a line drawn through the centre. At the top and bottom of the back of the glass I fixed small staples, *a b*, and one on A at C. At the back of A I also inserted a peg like one used for a violin; from the staple *a* to this peg I attached a "waxed thread," and joined *b* and *c* with an india-rubber band. The machine is fixed on the forepart of the platform C, so that it should fit tight up to the sash when used from the inside of the room. Place the heliograph on a table or window ledge. Turn B round till the sight-arm D is in line with the object, or distant station; look through the hole in the centre back, and adjust the sight by moving the arm up or down, then turn A, which should run with as little friction as possible on B, till you get the sun on the sight, and screw up the peg till the spot remains at the required position. By holding the machine by and near the peg to keep all steady and regulate the movements of the spot, and, with the other hand pulling the thread joining *a* and the peg, you can make the necessary obscurations, for the india-rubber will bring the spot to its proper place. A cardboard disc, worked by hand, will obscure quite well enough, and is useful to write notes, codes, etc., on. By turning the platform round the machine can be worked outside the window; prop the front up to prevent it from going over, as in Fig. 6.

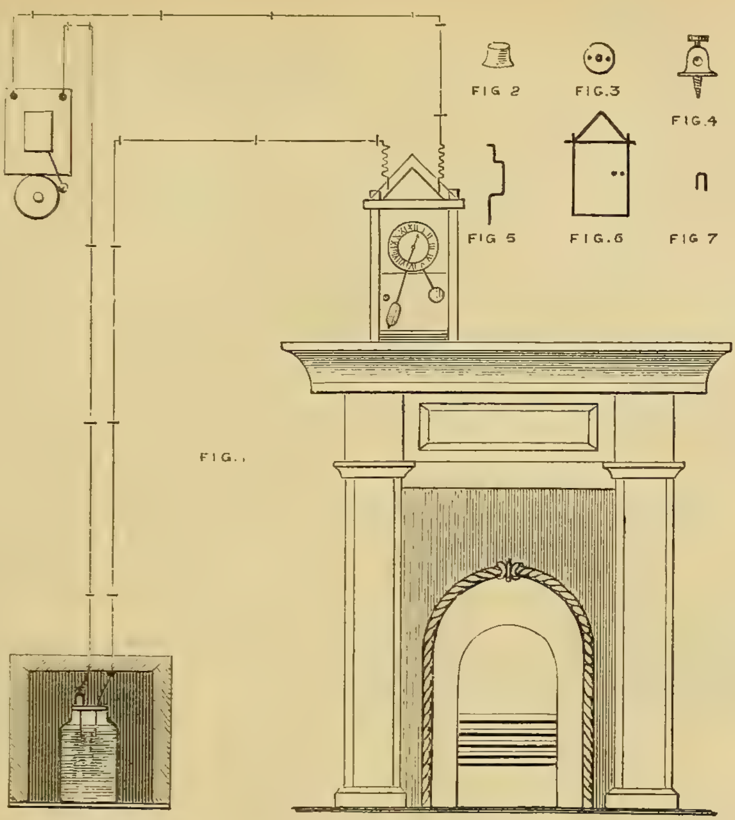


FIG. 1.—GENERAL ARRANGEMENT OF ALARUM. FIG. 2.—PIECE OF HARD WOOD PUT IN CLOCK CASE. FIG. 3.—METAL DISC ON HARD WOOD. FIG. 4.—TERMINAL. FIG. 5.—CONNECTING-ROD FROM TERMINAL TO CLOCK FACE. FIG. 6.—BACK OF CLOCK CASE SHOWING POSITION OF SCREWS WHICH HOLD DISC. FIG. 7. STAPLE ON WIRES.

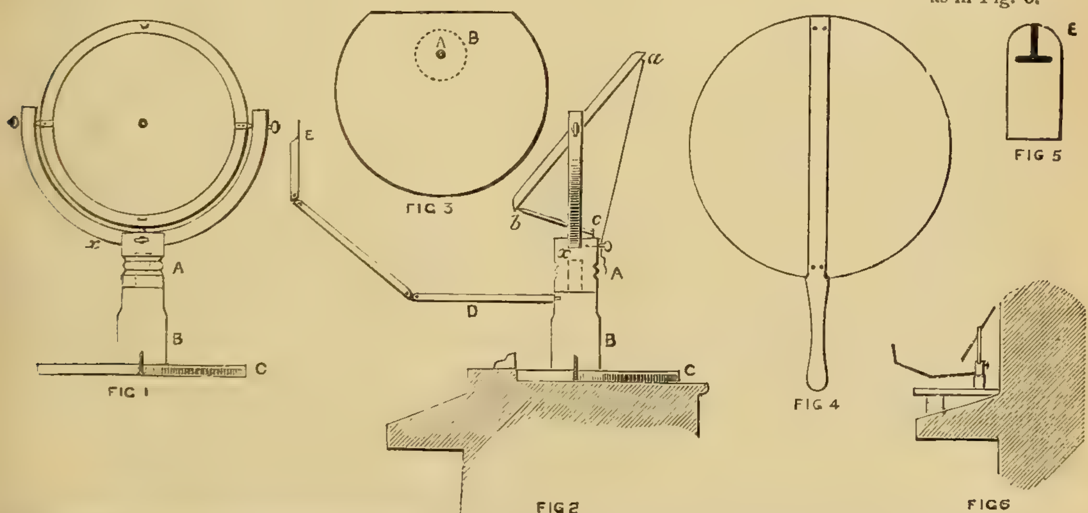


FIG. 1.—ELEVATION OF BACK OF HELIOGRAPH. FIG. 2.—SIDE ELEVATION. FIG. 3.—PLATFORM TO SUPPORT HELIOGRAPH—A, Screw-hole; B, Position of Shaft or Pillar, B, in Figs. 1 and 2. FIG. 4.—CARDBOARD DISC. FIG. 5.—SIGHT OF WHITE CARDBOARD. FIG. 6.—SUPPORT OF HELIOGRAPH WHEN USED OUTSIDE WINDOW.

NOTES ON NOVELTIES.

By THE EDITOR.

21. "CIRCULAR WORK IN CARPENTRY," ETC. 22. GAWTHORP'S MEMORIAL BRASSES, ETC. 23. FLETCHER'S GAS COOKING RANGES. 24. RAWLINGS' SPIRAL CUTTER. 25. ZILLES' BRASS FITTINGS FOR SMALL CABINETS, ETC. 26. CATALOGUES OF FARM IMPLEMENTS. 27. "ON THE TREATMENT OF HIGH-CLASS TOOL STEEL." 28. "PRACTICAL AMATEUR PHOTOGRAPHY."

21. "CIRCULAR WORK IN CARPENTRY," ETC.—This is a valuable addition to Weale's "Rudimentry Scientific and Educational Series," published by Messrs. Crosby Lockwood and Co., 7, *Stationers' Hall Court*, *Ludgate Hill*, *E.C.* The volume forms No. 258 of the series named, and costs 2s. 6d., which is low enough, considering the amount of information it supplies on a subject on which the majority of carpenters possess but a limited amount of knowledge, more, perhaps, because there is so little of this kind of work done, and is therefore entrusted to a few practised hands, than because it requires more skill than the ordinary carpenter can bring to bear upon it, for if a man is carpenter enough to do straight work, it is hardly fair that the majority are obliged to content themselves with this because they are not gifted with sufficient brains to enable them to proceed to the higher branches of their trade. The full title of the work is, "Circular Work in Carpentry and Joinery: a Practical Treatise on Circular Work of Single and Double Curvature." It is written by Mr. George Collings, author of "A Practical Treatise on Handrailing," and it is illustrated with one hundred and thirty-four explanatory diagrams. The book is divided into three parts, the Introduction, in which Circular Work is defined, and the framing specified, which chiefly requires a knowledge of the principles of the work in its construction. In the second portion, or Part I., as the author terms it—for the Introduction is but brief, and consists mainly of definitions—treats on Circular Work of Simple or Single Curvature; while in Part II., Complex Circular Work, or work of double curvature, is brought under consideration. All circular work must be laid out on geometrical principles, and the value of the book is enhanced by the clear and lucid manner in which the *modus operandi* is set forth and explained, both by pen and pencil by aid of geometry. The author himself is well practised in the kind of work on which he treats, and tells us "that he has either executed with his own hands, or has seen executed by others, examples of work similar to nearly every piece described in the pages of his work, and can vouch for the accuracy of the various methods given for finding the different moulds, and of applying them in practice. Any one requiring instruction in work of this nature cannot do better than take Mr. Collings' book in hand and go to work under the directions given.

22. *Gawthorp's Memorial Brasses, etc.*—Mr. T. J. Gawthorp, of 16, *Long Acre*, *London*, *W.C.*, was kind enough to send me some few weeks ago an intimation of an Exhibition of Amateur Repoussé Work, to be held at his place of business in December last. I was not able at the time to give publicity to it, for, if I remember rightly, the December Part of this Magazine (which is published about November 25) had gone to press before Mr. Gawthorp's communication reached me. I wish now, however, to call attention to the pamphlets sent out by Mr. Gawthorp, with illustrations of memorial brasses executed by him, many of which are most elaborate, while all exhibit marked artistic beauty and great skill on the part of the designer, and the executor of the mechanical portion of the work. Some of them bear the names of men who have made a mark in the history of our own times, as for example, Colonel Frederick Gustavus Burnaby, killed in action at Abu-Klea, January 17th, 1885," as runs the legend on the brass that perpetuates his memory; and not a few serve as a record of those who have fallen in battle in one or other of the actions that have taken place since 1850. The memorial brass, when the purse is long enough, is a means of placing an enduring record to any we have known and loved that commends itself very much to myself at all events, and I recommend it to the notice of my readers as useful for cherishing on the walls or pavement of the church in which we worship the names of those who may be lying in God's acre without the building or in some neighbouring cemetery. Prices will be found on the third page of the wrapper of the pamphlet. It would occupy too much space to reproduce them here, and if space were at my disposal it would be of little use to go into these details without the designs that accompany them, and show what is supplied for the money asked.

23. *Fletcher's Gas Cooking Ranges.*—I trust that those of my readers who may be thinking of adopting the mode of cooking by gas, which is daily becoming more and more prevalent, will not forget before providing themselves with the necessary apparatus to write to Mr. Thomas Fletcher, of *Warrington*, for one of his price lists. I believe Mr. Fletcher to be one of the most, if not the most, skilful gas engineers in England, and if I were purchasing for myself I should unhesitatingly give him the preference over all others, because I consider his gas ranges and appliances to be the most economical and effective of all that have yet been introduced. I do not stand alone in my opinion of Mr. Fletcher's ranges. Mons. H. Cedard, Chef de Cuisine to H.R.H. the Duke of Connaught, writing from *Bagshot Park*, *Surrey*, speaks thus of a range recently supplied for his use to the order of the Duke:—"I have great pleasure in expressing my entire satisfaction with the gas cooking stove supplied to me by Mr. Fletcher. By its admirable constructon it can be used for all requirements of the kitchen: one can roast in the oven, cook pastry, and regulate it perfectly at will. I also greatly approve of the grill and the excellent arrangements provided for cleanliness." Mr. Fletcher's ranges were used by Mr. Andrew Ritchie, the Manager of the Dining Rooms and Café at the International Exhibition, *Edinburgh*, during the time the Exhibition was open, and by their aid was enabled to serve from three to six thousand persons daily with ease, efficiency, and economy. Mr. Thomas Horton Williams,

of the Refreshment Rooms, 27, *Thistle Street, Edinburgh*, was able to cook easily for a hundred persons per day with a No. 6 range, and Mr. James Darling, who was manager of a café, also in connection with the Edinburgh Exhibition of 1866, was able to meet the requirements of five hundred persons daily with a No. 6 and No. 12 range. And wherever Gaslight and Coke Companies have let out cooking ranges on hire, purchased from Mr. Fletcher, the results obtained from their use has invariably given the highest satisfaction.

24. *Rawlings' Spiral Cutter.*—A little pamphlet has been placed in my hands entitled, "A Few Facts concerning the Spiral Cutter, Rawlings' Patent, together with Remarks on Wood Cutting generally," from the pen of the inventor and patentee, Mr. John Rawlings, 188, *Dalston Lane, London, E.*, and 78, *Hackney Road, E.*, his warehouses, where I presume his machines may be seen and inspected. The spiral cutter, I may explain at once, is the name of a planing machine introduced by Mr. Rawlings, and so called from the form of the blades of the cutter which are arranged about a central axis, so that their cutting edges form spiral lines from end to end, after the manner of the blades of the cutter of a lawn mower. Mr. Rawlings shall tell his own story with regard to the efficiency of the spiral blades of his cutter and their superiority over the straight blades now in general use in wood-planing machines. These straight blades, he says, "are very unscientific, inasmuch that the blade makes a simultaneous chop the whole width of the boards operated upon, and then no more is cut until the next blade comes into position, when it chops out a similar piece. This simultaneous chop causes a great shock, and, consequently, continuous trembling of the wood, which springs up during the interval of the cuts and is kept in constant vibration; hence every cut or chop is perceptible in the work, which will require hand planing or scraping to complete it. The same objection applies to the cutter shaft and blades, which is also in a constant state of vibration in consequence of the repeated shocks caused by the simultaneous chopping of the blades.

"Another objection to the straight blades is that only when they are in their sharpest condition will they take up the fine shaving necessary in good planing. The result is that many revolutions of the cutter are made and nothing is taken off; in some instances as many as ten revolutions of the cutter are made before the feed has passed sufficient wood for it to take up a shaving, and then it is a thick one taken off with one of the blades (the sharpest and most prominent), whereas a cutter with three blades should have taken off thirty shavings in the same time if every blade does its appointed work.

"The Spiral Cutter"—for the shape of the blades see the annexed illustration—"is designed to obviate the foregoing difficulties. It cuts only a small portion of the wood, but is cutting that small portion continuously during the whole revolution of the blade. It cuts at an angle of 22½°, and gently drawing into its work and takes off the finest shaving, shearing a small portion from side to side of the work. When a blade has worked to 7½ inches from one side of the wood, another blade commences cutting, so that with a 30 inch cutter all the blades will be working at the same time, and that continuously, working smoothly and evenly and causing no vibration or shock whatever to the work or the cutter. The Spiral Cutter does its work at comparatively slow speed and with very little power. Shearing at an angle being the only practical way of cutting wood, it does not require the destructively high speed necessary with the old system of straight and chopping blades. For clean cutting of rough and gnarly wood the Spiral Cutter will be found highly efficient. A knot will be gently sheared away from side to side, and will not, as in straight blades, be driven out with the force of the forward blow across the whole width of the knot. The Spiral Cutter with all the blades doing its appointed work, can be fed at the rate of 15 feet per minute, and will do its work equally well as with a slower rate of speed; 12,000 shavings will be taken off during the 15 feet, or 65 shavings per inch, which will be necessarily very small."

For the use of this machine, as Mr. Rawlings explains, a special apparatus is required, by which it can be quickly and accurately ground; but for a description of this I must refer the reader to Mr. Rawlings' patent. It must be under-

RAWLINGS' PATENT SPIRAL CUTTER.

stood that I mention this machine rather with the view o calling attention to its principles than of recommending it to amateur wood-workers for purchase, for the weight of the smallest hand-feed surfacer, to plane any width up to 12 inches, is about 8 cwt., and its price £30; and in addition to this, the price of the patent grinding apparatus, which must be bought with the surfacer to grind blades of 12 inches, as shown in the illustration, is £11 10s.; and, further, the machine must be worked by steam power. Still I cannot help thinking that it is possible to apply the principle to a machine for amateurs' use that may be worked by hand or foot power, and to furnish a sharpener for the blades similar in plan and action to that in use for sharpening the blades of mowing machines. I may conclude my notice of Mr. Rawlings' Spiral Cutter by calling attention to another of his patents, namely, his *Handy Plugs and Cams* for holding boards or other work, on joiners', cabinet-makers', or other wood-workers' benches. With these one plug is dropped into a hole in the bench, and when the wood has been butted against it, it is caught and tightly gripped by another plug dropped into another hole in the bench at the opposite end, and furnished with a projecting surface or edge and handle, the edge being on the principle of the cam, so that pressure can be exerted on the wood as the handle is turned in one direction or the other, as may be needed. These plugs are sold at 1s. 3d. per pair, and are of special advantage in saving time by causing a piece of wood to remain firmly fixed to the bench whilst being planed or otherwise operated upon, and preventing the wood from

being jerked off the bench on to the floor, which will happen occasionally to the best of carpenters when the old stop is used. Of course, the surface of the bench must be covered with holes at intervals, to admit of the securing on the bench itself pieces of wood of sizes smaller than the top of the bench, and in any position. This does not improve the appearance of the bench, but the utility of the plugs makes ample compensation for the disfigurement of the bench.

25. *Zilles' Brass Fittings for Small Cabinets, etc.*—I have received from Mr. Henry Zilles, 9, *South Street, Finsbury, London, E.C.*, some very attractive specimens of small fittings for fancy cabinets and other purposes, and, as all of these are not only inexpensive, but well-made and beautifully finished, they cannot fail to prove useful to a very large section of amateur wood-workers, and will be, without doubt, in great demand among its members. The specimens sent are so numerous that it is not possible to notice them individually, and all I can do is to enumerate them and give their prices. This, I venture to think, will be useful to amateurs, inasmuch as it will help them in making a selection, and serve as a guide to the various articles that are comprehended under the title of cabinet fittings :—

			s.	d.
Hooks for Cabinet Work ...	Straight	per gross	3	0
,, ,, ,,	Curved	,,	4	0
Watch Hooks	Small	per dozen	1	3
,, ,, ...	Medium	,,	1	6
,, ,, ...	Large	,,	2	6
Brass Knobs to Screw ...	Small	,,	1	6
,, ,, ,, ...	Large	,,	2	0
,, ,, ,, ...	Fancy	,,	2	6
Surface Hinges, Nickel Plated,	Small	per doz. pair	3	0
,, ,, ,, ,,	Large	,,	4	0
,, ,, Brass ...	Large	,,	4	0
Picture Eyes	...	per gross	3	9
Fret to Screw, Knobs, ...	Large	per dozen	1	0
,, for Caskets, Brass ...	...	,,	7	0
,, ,, Nickel-plated	...	,,	8	0
Rings forming Swing Handles	...	,,	4	0
Catches, Brass	Small	,,	2	6
,, ,, ...	Medium	,,	3	0
,, ,, ...	Large	,,	3	0
,, ,, Nickel-Plated	Plain	,,	4	0
Catches, Nickel-Plated ...	Ornamental	,,	5	0
Scandinavian Locks and Catches	Nickel-plated	,,	12	0
Cupboard Ornaments ...	Various	,,	6	0
Brass Strips	...	,,	1	0
Fancy Brass Metal	Bold	per foot	0	4
,, ,, ,, ...	Fine Stamped	,,	0	7
Brass Corners	Antique	per dozen	1	0
,, ,, ...	Square	,,	2	6
Escutcheons	...	,,	1	6
Ornaments for Cabinet Work	...	,,	1	6
Brass Handles...	Small	,,	3	0
,, ,, ...	Medium	,,	7	0
,, ,, ...	Large	,,	12	0
Small Box Locks	...	,,	7	6

26. *Catalogues of Farm Implements.*—Readers of Mr. Edwinson's series of articles on "Handy Work in Farm and Garden," recently published, and the present series of articles on "Smithing and Forging," will be interested in knowing where to obtain the best agricultural implements. We have, therefore, much pleasure in noticing a splendidly illustrated new catalogue of "Agricultural Machinery," received from Messrs. Ransome, Sims, and Jeffries, Limited, of the *Orwell Works, Ipswich, Suffolk.* The implements likely to commend themselves to amateurs are, the R. H. A. pony plough at £2 5s., and the lawn-mowers at various prices, from £1 10s. upwards. The excellent implements turned out by this firm are beautifully illustrated in their catalogue, which we heartily commend to the notice of our farmer friends.

Messrs. Kell, Meats, and Co., Agricultural Engineers, of *Gloucester*, send their revised illustrated catalogue of agricultural implements. This is also a beautiful 48 page pamphlet, full of instruction to agriculturists. Among the list of seed drills, we find one specially recommended to small occupiers and market gardeners. It is a small hand drill for sowing all kinds of seeds in rows, and the price is £2 5s. This firm makes and sells a handy chaff-cutter, price 30s.; a root pulper, price 32s 6d.; a sack cart, price 15s.; hog trough, price 12s., and other farm requisites at equally low prices.

Gentlemen intending to fence and improve their own landed property, should first send to Messrs. Bayliss, Jones, and Bayliss, *Victoria Works, Wolverhampton*, for their new illustrated and descriptive catalogue of iron fences, gates, tree-guards, vases, garden seats, rollers, lawn-mowers, barrows, fountains, swings, pumps, bins, troughs, cisterns, fittings for stables, etc. It is a large book of 150 pages, profusely illustrated with engravings of beautiful artistically designed ironwork for use on the farm and garden.

27. "*On the Treatment of High-Class Tool Steel.*"—This is the title of a pamphlet by Mr. Arthur Y. Jacobs, of *Sheffield*, published by Messrs. Pawson and Brailsford, of the same town, from whom it may be procured, but at what price I am unable to say. In all probability, it will be sent to any applicant by the author, who evidently has good reason for desiring as wide a circulation for it as possible. The paper, as given in the pamphlet, was written for the Iron and Steel Institute by the author, and was to have been read by him at the autumn meeting of that body, held in London in 1886. It was duly announced for reading in the preliminary programme of the Institute, but eliminated from the final programme at the eleventh hour. Why and wherefore does not appear from the correspondence between Mr. Jacobs and Mr. J. S. Jeans, secretary to the Iron and Steel Institute, which forms a sort of preface to the paper itself, and which will be read, I am inclined to think, by most persons with entire sympathy with Mr. Jacobs, mingled with gratitude to the Institute for supplying Mr. Jacobs with a copy of his paper which they refused to read, but, nevertheless, kept on the plea that "when a paper is presented to a scientific society, the MS. becomes their property, whether it is read or not." The paper itself affords much practical information on the manufacture of tool steel, which will be interesting to all amateurs who are workers in metal.

28. "*Practical Amateur Photography.*"—Mr. C. C. Vevers sends me a small pamphlet of fifty pages that he has just produced on this subject and under this title. Its price is 6d., and it is published by the author at *Horsforth, Leeds.* It is well illustrated. Readers of AMATEUR WORK will recognise Mr. Vevers as the author of the series of papers entitled "Dry-Plate Photography," now appearing in these pages, and as these show how thoroughly capable Mr. Vevers is of dealing with photography, there is no occasion for me to dwell at length on his pamphlet.

AMATEURS IN COUNCIL.

For "Instructions to Contributors and Correspondonts," see page 44 of this Volume, or Part 60, page 44.

Notice of Removal.

Messrs. H. and E. J. Dale, Manufacturing Opticians and Electricians, and Electric Bell Contractors, request me to notify to the readers of AMATEUR WORK the removal of their Warehouse for Electric Fittings from 4, *Little Britain*, to their other premises, viz., Show Rooms and Offices, 26, *Ludgate Hill, E.C.*; Wholesale and Factory, 9, *Kirby Street, E.C.* Having thus concentrated their business, they trust to be enabled to give more direct personal attention to every detail. Their stock will be found complete in every way, and well worth the inspection of amateurs seeking any speciality for the construction of Optical Instruments and Electric Appliances.

Covered Copper Wire.

K. (*Kilburn*).—It is not possible for me to say *where* you can purchase covered copper wire for electrical purposes at the cheapest rate. To do this fairly I should have to collect the catalogues of makers and sellers of electrical appliances and compare prices. Again, it does not follow that goodness and cheapness are always linked hand in hand. The best course you can pursue is to obtain the price lists of the many electricians who advertise in AMATEUR WORK, and those whose specialities have been mentioned in "Notes on Novelties," and judge for yourself. It is within the power of amateurs to cover wire for themselves. I have an article awaiting publication describing a machine by which this can be done.

Wheels with Lathe.

E. E. (*Marlborough*). — You say you "have bought a lathe, and with it are several pulley wheels, various sizes, similar to enclosed sketch." Of course I cannot say whether or not the wheels that you have bought with the lathe positively form part and parcel of it, but if they do belong to it they are what are termed "change wheels," used in screw cutting. You should get some turner, amateur or professional, to show you how to use them. You will further find much useful information on Change Wheels and Pulleys in Chapters X. and XI. of "Lathe Building for Amateurs," by James Lukin, Vol. III., pp. 518, 571, of this Magazine (or otherwise Parts 34 and 35).

Applegarth's Corrugated Carbon Cells.

LEX.—I cannot speak from actual experience with these cells in the work of actuating an electric clock; but should not deem them equally suitable with a modification of a Daniell cell, such as that recommended by Professor Marissiaux in Part 49. The corrugated cells are most excellent for electric bell work and for medical coils. They are practically dry and clean, and free from all mess. They also keep in order for a long time in this work, and are easily repaired. I have also tried the corrugated carbons alone in a solution of sal-ammoniac for electric bell work with marked success. Although superior to the Léclanché, they share some of the defects of the sal-ammoniac batteries in working somewhat spasmodically. The patent rights have changed hands, and are now the property of Messrs. Judson. Will try to help you or any other reader in procuring the cells or the carbons should you desire to try them. Address me, care of Editor—G. E.

Recipe for Polish.

W. G. G. writes:—"Explain recipe for making varnish, page 262, Vol. III.—'benzoin to one gallon of spirit,' no quantity given, and what is meant by 'benzoin?'" [The recipe to which you allude is one for polish, not varnish. If you put "glaze, 2 lbs.," before the words you quote, or, in other words, read the whole clause of the recipe and not a part of it, your difficulty will, or ought to vanish, *the quantities being given*, as you will see. Benzoin is a resinous substance, dry and brittle, obtained from the *Styrax benzoin*, a tree of Sumatra, Java, etc., having a fragrant odour and slight aromatic taste. It is sometimes called Gum Benjamin.

Plane for Curled Shavings.

W. G. G.—You ask for a description of plane required for making spills of wood (thin curled shavings). If you will kindly call on Messrs. R. Melhuish and Sons, 85 and 87, *Fetter Lane* (*Holborn End*), *London, E.C.*, they will have much pleasure in showing you the plane you mention, and pointing out its construction and action.

Japanese Saucers.

LEO.—You may obtain the Japanese saucers, which are about 2½ inches across, at the warehouse for Japanese goods, kept by Messrs. Phillips and Co., Tea dealers, *King William Street, London Bridge, E.C.*, or at shops where fancy goods are sold; as for example, Mr. George Rooke's, *Newgate Street, London, E.C.* Mr. Rooke always has on sale a large variety of Japanese china, carved brackets, and articles of this description, and a letter to him will doubtless obtain for you what you require. But are there not shops and warehouses of this description in Liverpool?

Crucible for Brass Casting.

A WOULD-BE MOULDER.—In regard to the crucible you want, I believe you would get a very good one from Mr. Fletcher, of *Warrington*, who I know will courteously answer all enquiries you may address to him; and in regard to the brass casting, you will get a few hints in Mr. Durance's papers, published in the second volume of AMATEUR WORK, that will be of service to you. Perhaps some future time I may go into the subject more fully; however, for the present, lay well the following to heart: In sand moulds for brass you will find, whatever you put on the surface of mould, the metal has a tendency to eat, so to say, into the sand; a great deal will depend on how you ram the pattern and the kind of sand you are using; with the fine sand or dirt in main roads, blown together by the wind, you can produce creditable castings, so that if no foundry is near at hand you can get suitable material for your work. For surfacing the sand you might dust with a flour bag, which is merely a thin piece of rag filled with the commonest flour: the mould should be dusted all over with it. For plaster moulds, however, you must adopt a different method: some greasy substance, such as, however, will not stop the gases from leaving the mould, is preferable. By-the-bye, perhaps that is where you have failed, not knowing that a mould should be honeycombed, as it were, all over it, so as to allow all gases generated to escape; if they have not done so, you may be sure they will leave their mark on the casting. Further particulars if required.—A. J. S.

From "The Growleries."

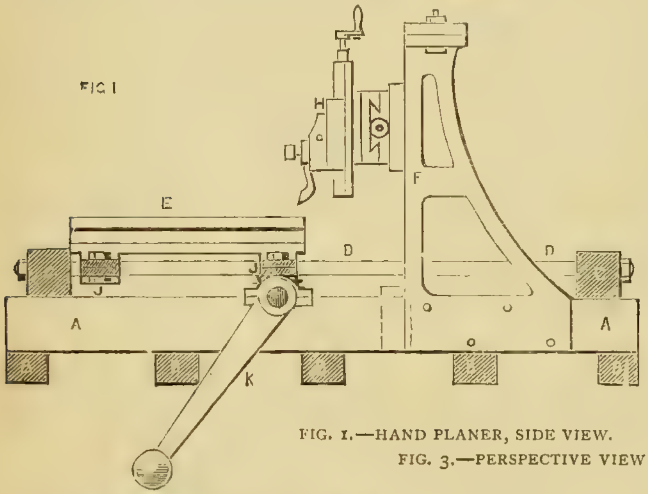
E. T. B. (*Cheltenham*).—In a letter which occupies ten pages of note-paper, you take exception to thirteen subjects which have been, are being, and are to be treated in the pages of AMATEUR WORK. I accept it as it is meant, namely, "as a kindly criticism and matter for consideration," and so I forbear to go over the ground step by step and meet your objections *seriatim*. It will be enough, I am sure, when I say that most of the subjects which you named, especially "The Magic Lantern," have been asked for by a great number of readers; and that those which have not been asked for have been accepted by myself, as Editor, as being likely to meet in some respects the wants of various sections of readers. *Apropos* to "Smithing and Forging," it is as possible for an amateur to shoe his horse as for a professional blacksmith, and an amateur who loves his horse, and would as soon hurt himself as his animal, and perhaps sooner, is more likely to do less harm at starting than the rougher apprentice. All must have a beginning. I have heard of an officer, engaged in one or other of the earlier South African wars, who could shoe his own horse, and said that the knowledge proved of the utmost value to him during the campaign. Why should not colonists abroad and dwellers at home do the same, if they have an inclination for the work?

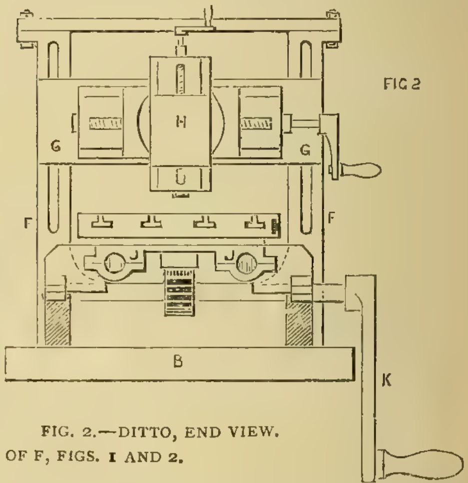
Street Medical Coil.

H. A. S.—1. The hand on the dial is worked by a catgut string passing from the covering tube of the coil, around pulleys, to a wheel at the back of the dial. As the tube is drawn out it pulls the hand around. 2. The Bunsen is in general use. It works best without nitric acid for this purpose. Use only sulphuric acid in the porous cells. Applegarth's Battery is the most portable and cleanly. 3. Two long pivoted levers will be needed to reverse the current as you require, one above and one under the table, or insulated from each other by ebonite. The two cross each other like the letter X to reverse the current, the two inside limbs connected with the positive and negative studs, and the two outer limbs on the studs connected with the handles. 4. It is still my intention to fulfil the promise, when able to do it; but am at present prevented by press of other work. —G. E.

Another Lathe-Planer.

H. H. D. B. writes:—"Seeing the discussion going on at present in your columns concerning lathe-planers, I send a sketch of a separate planer that I have devised, and should be much obliged if some of your readers would give me their opinions upon it. A, A, are two hard wood bars joined together by the cross-pieces B, B, B, B, B, on the underside, and on the top side by the two pieces C, C, which also support the two parallel bars D, D, on which the table E slides. The two upright frames F, F (a perspective view of which is shown in Fig. 3) carry the cross-piece G G, to which the slide-rest H is fastened. The slide-rest would only be used temporarily to plane the table and the parts for a proper cross-slide like a real planing machine's. I have only shown it for hand feeding, but when the cross-slide is made a self-feeding gear could be added. The bars D, D, run through adjustable bearings, J, J, J, J, on the underside of the table. Motion is imparted to the table by a rack and pinion seen in the drawing, and worked by a handle, K. The rest of the drawing, I think, explains itself. If the wooden framework is not strong enough, how would an iron one on something of the same plan do, as the bars are much easier to make than the slides? What ought diameter of bars to be if they are about 3 feet long, and would iron do, or would they have to be made of steel?"





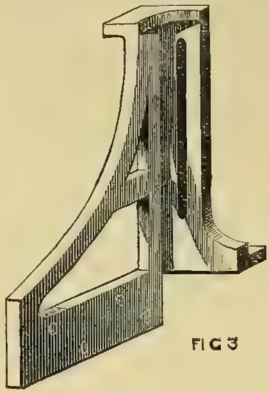


FIG. 1.—HAND PLANER, SIDE VIEW. FIG. 2.—DITTO, END VIEW.
FIG. 3.—PERSPECTIVE VIEW OF F, FIGS. 1 AND 2.

Harp Making.

W. H. E. (*Dartford*).—No paper or series of papers on harp making has yet appeared in this Magazine. I doubt very much if it be within the power of an amateur to turn out a harp precisely similar to those which are sent out by the makers of these musical instruments. It may be possible, however, to make a very fair substitute. I do not know the kind of harp used in Wales by the modern Druids for "penilion" singing; but I suppose it to be more simple in its construction than the harp proper. Will any Welsh reader who is acquainted with its construction give a description of it, and tell us how to make it.

Zilles' Designs for Fretwork.

C. M. (*London, S. W.*) writes:—"I have just completed a cabinet in the 'Renaissance,' or revival style, from patterns Nos. 730 to 732 of Mr. Henry Zilles, and think other amateur woodworkers could not do better than try it, as it is a very beautiful design. I have made mine of American walnut, dull polished, with brass hinge fronts, key-hole, escutcheons, etc., but think it would look equally well, and have a more antique appearance in dark fumigated oak, with bright steel or iron escutcheons, etc. I can thoroughly recommend Mr. Zilles' fretwork designs as most artistic, there being nothing in them that savours of the commonplace, childish patterns so much objected to by many people in fretwork." [I am glad to give publicity to your letter. There will be more articles on Decorative Carpentry by and by.—ED.]

Band Saw for Circular Saw Bench.

H. H. D. B.—A scroll saw might be fitted, but a band saw would be rather too much. When I designed the machine, I considered that a sufficient number of appliances were added to it. However, if you are desirous of using the fly wheel and treadle as a source of motive power, instructions for making a band saw have already been given in a back number of AMATEUR WORK. I cannot at present quote the part in which this appeared, my copies being in the binder's hands. The article referred to will give you a clear idea of the arrangement of a band saw; and as for working it in to suit the saw bench, no one would be able to better do that than yourself, seeing that you specify your numerous conditions so very clearly. With regard to the scroll saw, I have a query about that business on hand which I intend illustrating with a sketch when I can find a spare moment.—OLLA PODRIDA.

Polishing Ivory and Bone.

H. H. B. C. S.—After scraping or turning the ivory or bone, rub first with fine glass paper and then with powdered pumice-stone applied with a piece of wet linen rag. Lastly, rub over with washed chalk or fine whiting, applied by soft linen or woollen rag dipped in soap suds. This will give a good polish. Ivory and bone are stained by immersing them in various dyes. Name any particular colour you require, and I will tell you what to do. It would take too much room to go into every colour here.

The Violin: How to Make It.

THOMAS S.—Mr. Allen's papers, entitled, "Violin Making: As it Was and Is," appear in Parts 2 to 14, inclusive; and the continuation, "The Violin: How to Make It," in Parts 16, 17, 18, 20, 21, 22, 23, 26, 28, and 29; and there are two papers on Making a Violin on the Guarnerius Model, in Parts 39 and 40.

Case for Ferns.

SEMPER EADEM writes in reference to this subject (Vol. VI., p. 92):—"If LINNÆUS will state his wants more particularly, whether he wants an octagonal-shaped fern case for centre table, or large oblong one for bay or other window, or one for outside of window sill, I shall be able to help him; but a great deal depends upon what kinds of ferns he intends to keep in the case. Lastreas, Pteris-Woodwardia, Radicans, and some kinds of Adiantums require a high case, while others, such as Todeas and Hymenophiliums require only a low case with a constant drip of water about them."

Naxos-Union Company, Etc.

STADT DRESDEN.—I am obliged to you for your communication, *Re* Naxos-Union Company. A correspondent — R. A. W. (*Dublin*)—has already supplied the address of an English agent for the sale of the Company's specialities, as you will see on reference to "Information Supplied" in this Part. I fear, however, that these words may never come under your notice, as you say :—" Not being a subscriber, the notice in page 570 (Vol. V.) escaped me. I only obtain the magazine now and then, about every two or three months." It is no use to buy or borrow a magazine spasmodically, and at intervals few and far between. If you find any difficulty in getting AMATEUR WORK in Dresden, the publishers would have much pleasure it sending it to you monthly, if you will write to them and send them your address and a year's subscription. It is scarcely worth while to publish your appeal for a recipe for good writing ink, for to use a time-honoured formula—every schoolboy knows, or ought to know, how ink is made. I should have thought it within the bounds of possibility to get good ink in Dresden, although you write—"The stuff one gets here called 'ink' is merely discoloured water with some fluff and mud added. It also attacks the steel pens like an acid would." Poor people of Dresden! I give your graphic description of *soi disant* Dresden ink in the hope that Morell or some other English manufacturer of ink, that is not made purely and simply of discoloured water, fluff and mud, may appoint an agent there, and save the Dresdenese the trouble of becoming every man his own ink-maker. I do not give *in extenso* your reply to JACK, in the matter of a "Vehicle moved by Spring," because I do not think it will be of much use to Jack, or anyone else, especially as the springs will cost from £5 each, two being required, or one large spring which will cost about £8. For the same reason I do not put into type your remarks to R. K. (*Chelsea*) about "Improvement in Davy Lamp" (Vol. VI., page 96, or Part 61, December, 1886), but I am comforted in having evidence before me that you are posted up in the magazine to this date. In the matter of the "Shipman" Engine I am glad you are at one with me respecting its merits; but my pleasure is somewhat damped when you tell me that "the German police are a little officious and will not allow high-pressure engines in dwelling-houses," and that you are therefore compelled "to devise some kind of high pressure safety engine." All I can say is that when you have beaten the "Shipman" you will have proved yourself an inventor of a very high order, and will be entitled to, and receive, my warmest congratulations. No, "we won't quarrel" about the "Pattern for Planing Machine Bed." You asked A. J. S., one of the best pattern-makers in England, how to do something that was not possible, namely, to make the pattern without cores. He could not accede to your request, but he told you what you ought to do and how to do it, and yet you are not happy. Your advice to S. M. L. (*Goderich, Canada*) I withhold, because he would be able to extract nothing useful from it, beyond the fact that working on minute fittings required for model engines has "damaged my eyes"—yours, you know, not mine, which we must all regret. Lastly, with reference to your sketches and remarks on "Modification of Slide-Rest for Shaping," which will occupy a great deal of space, I have submitted them to your old friend, OLLA PODRIDA, and another practical engineer, who are far better able to judge of their value than I am, and if they endorse your views they shall be published. But you must remember, after all, that your large sketch is only a modification of somebody else's machine.

Price for Fine Screws—Erratum.

W. G. G.—The price of fine ¼ inch screws, which is given in page 42, Vol. VI., November, 1886, as being 15s. 6d. a gross is a misprint for 1s. 6d. per gross. The compositor read copy wrongly, and the error, although palpable enough, escaped observation.

Phonograph.

LEX.—As soon as I can meet with any one who is willing to write a paper on the construction of the phonograph, the promise made shall be redeemed.

A Wrinkle for Fret Sawyers, etc.

DICKY SAM writes :—"Various 'graph' compositions have been described from time to time in Amateurs in Council. Here is one that is always handy. It is not quite so good as the regular mixtures, but it answers very well, and its extreme simplicity is a great advantage. It is merely ordinary glue with more water than usual, *i.e.*, glue made rather thinner than when used for adhesive purposes. Pour some of this into a plate or dish, and when it has become a jelly it can be used like any other 'graph.' It is quite good enough to reproduce a few fret designs; but as the moisture evaporates after a time, it requires to be re-melted and more water added. Perhaps this is the reason glycerine is used in graph compositions.

Melting Points of Tin, Lead, Bismuth, etc.

F. S. (*Folkestone*).—1. The melting points are: Tin, 442°; Cadmium, 442°; Bismuth, 507°; Lead, 617°; Zinc, 773°; Antimony, 1150° Fahrenheit.—G. E.

Metals for Solders.

F. S. (*Folkestone*).—Here, in London, we usually apply to the nearest tool or metal merchant, or to an ironmonger, for any ordinary metal, such as those used in making solders. If you cannot get what you require from your local tradesmen, doubtless you can have it sent in return for cash from any one of the tool vendors advertising in AMATEUR WORK.—G. E.

Electro-gilding.

ELECTRO.—No papers have appeared up to this time on Electro-gilding, although instructions have been given for carrying out the process of Electro-silvering by Mr. George Edwinson in Vol. I., in the series entitled "Electro-plating at Home." Electro-gilding is a subject with which Mr. Edwinson has yet to deal, and he will do so as soon as his existing engagements will permit.

Bellows for Church Organ.

ORGANIST. — I think it very doubtful whether your bellows would be large enough for the church organ as reconstructed, as it would have only about half the capacity usually allowed for each stop. It also seems to be a mistake to abolish the "mixture," which is so useful to give fulness of tone to an instrument used for sustaining a large number of voices.—M. W.

Octave Coupler to Pedal Organ.

J. J. E. (*Leeds*).—If you will refer to my articles on "Organ Building," in Vols. II. and III., you will find all the information necessary to enable you to add an octave coupler to your pedal organ.—M. W.

Glass-blower's Lamp and Bellows.

A. W. W. (*Southgate Road*).—In the lamp figured 10, page 85 of Vol. V., the part C is narrower than A, because it is only to hold the lighted end of the wick, whereas A is to hold the supply of tallow. The wick trough is slanting, because the lighted end of the wick is above the lamp, whilst the remainder falls to the bottom. The slanting piece, D, runs horizontally *over*, but not *on*, the wick trough; it rests upon a ledge fixed to the inside of C. The flange round the bottom of the lamp is a tray, and is intended to catch any melted tallow that may chance to flow from the lamp. The body of the lamp may be about 6 inches long by 4 broad, and 1½ high. The bellows described in page 52, Vol. I., are unnecessarily large for glass-blowing. Make them about a foot square and 6 inches high in the reservoir, with three or four holes communicating with the blower, and a single outlet of about ¾ of an inch bore. Arrange the lever so that it can be worked by the foot.—A. W. S.

Magic Lantern Slides.

H. S. will unquestionably find slides in oil much more brilliant than in water, and what is also very important, much more substantial and enduring, unless the "water" is placed between two glasses, which is cumbersome. The baking process is the chief cause of delay in oil; but in my opinion the results are worth it. But the delay is very little indeed, if any, when a number of slides are being painted. Say you have a dozen slides, then by the time all the work is put in, in any one stage in the dozen, most amateurs would think they had done enough, and would be glad to wait till to-morrow. One fact I think should have weight, the best slides are as a rule worked in oil by artists. If H. S. intends serious work, it would perhaps be the best to work a few slides in each way, he then will be able to determine which he likes best. If desirable I will, if desired, give a short paper on the process of Water Colour Painting.—O. B. [Kindly do so.—ED.]

INFORMATION SUPPLIED.

Billiard Table.

A. SINUS writes in answer to H. B. J. (*Worcester*) :—"A billiard table as suggested could hardly be described in the space devoted to Amateurs in Council. It would require great nicety in the working,

and I fear would not be satisfactory when made, owing to the difficulty of keeping it perfectly level. In lifting it on and off the dining table it would be liable to get strained and twisted. At best, it would be little more than a toy table if made in the smaller size named. However, if the Editor can spare space, and thinks the subject would be acceptable, I shall be happy to write a short article. I fancy a bagatelle table would be more within the ordinary amateur's capabilities. Would this suit H. B. J.?

Laryngoscope.

RACAVAR writes, in reply to J. G. B. (*Nelson, N. Z.*), p. 48. "1. Take two Geisler tubes, put into the throat, attach to electric current, when the throat will be lighted up for examination. 2. Take a circular mirror with a hole in centre for eye to look through, as in Fig. 1. Throw reflected rays from lamp into patient's throat, and look through aperture in mirror, as shown in Fig. 2.

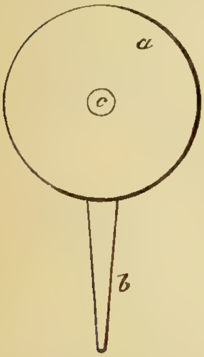


FIG. 1.—CIRCULAR MIRROR.

a, Mirror; b, Handle; c, Round hole to look through.

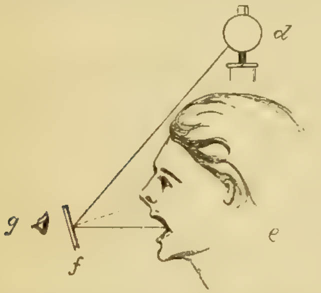


FIG. 2.—MODE OF APPLYING LARYNGOSCOPE.

d, Lamp in rear of patient; e, Patient, rays reflected into his throat; f, Mirror or Laryngoscope; g, Operator's eye.

Stake for Seaming Sheet Metal.

SEMPER EADEM writes in answer to TINMAN (Vol. IV., page 96):—"If TINMAN will be more explicit as to what his stakes are wanted for, whether he wants to seam together, or groove together, is the trade term here, in Cumberland, two or more pieces together for the bottoms of sheet metal articles—then he will require an edging machine, or, in lieu of that, a hatchet stake, a hand groover, and tinsmith's anvil; but if he wishes to put a sheet metal bottom on the sides of an article, he will require a hatchet stake, a pinning-down hammer, an edging tool, and a horse with several heads to it for different sized articles. But if I were TINMAN, I should go to the nearest blacksmith and get him to make me a forging suitable for my purpose, and file it up myself, and then carry it back to him to temper, as tinsmith's tools are always faced with steel.

Naxos-Union Company.

R. A. W (*Dublin*) writes in reply to enquiries made by F. A. E. (*Bailieboro'*), and G. M. H. (*Blackheath*), Vol. V., page 570, that the Naxos-Union emery wheels can be obtained from Messrs. Buck and Hickman, 280 *and* 281, *Whitechapel Road, London, E.*

INFORMATION SOUGHT.

Bagpipe Chanter.

J. W. S. (*Orkney*) writes:—It would much oblige if Co. CAVAN will give me information on finishing pipe chanter, the length, size, and position of holes, and smoothing off. I have a lathe same as explained by OLLA PODRIDA in AMATEUR WORK. [Kindly send me your name and full address, as I have a letter for you which I am unable to forward until I am in possession of them.—ED.]

Construction of Sash Windows.

J. W. S. (*Orkney*) writes:—I should like to see a paper or so on Sash Window Making, with weights and otherwise. Perhaps some able correspondent will give a paper on this important subject, as there is very little information to be got on the above subject in *Ultima Thule*. [Will any practical man take this in hand, and write, expressing his willingness to furnish a paper or two on the subject?—ED.]

Pieces of Lincrusta Walton.

SEMPER EADEM asks:—Can any reader of AMATEUR WORK tell me where I could procure small portions of Lincrusta Walton suitable for panels for hanging shelves, etc., which have appeared in AMATEUR WORK?

Recipe for Glaze.

W. G. G. asks for a recipe for glaze. [The "glaze" used for polishing wood is meant.—ED.]

Invalid's Chair.

S. S. (*London, N.*) writes:—"Can any of your readers kindly furnish a sketch (no matter how rough) of an invalid's folding chair, such as made by Trotman, showing the angles at which the back and footboard respectively are placed, and the distances of the various bolts from each other. I only require sufficient information to set out a working drawing, as I understand the principle, but have no opportunity of taking measurements from a finished chair."

Lessons in French Polishing.

W. G. G. asks:—Can you give name and address of any professional who would be willing to give some lessons on French polishing and its various branches? [I cannot; but possibly this may induce someone to volunteer to give the assistance you require.—ED.]

Saddler's Needles.

W. G. G. asks:—Where can saddler's needles and the *prepared* hemp of a light colour (such as is used for stitching riding bridles) be bought?

Glaze, Polish, etc., Where to Buy Them.

W. G. G. writes:—"In Vol. III., page 406, name of firm is given where glaze, polish, etc., can be bought. Shop now shut up. Can name or address of any other firm be given? There is no such place really as *St. John Street, Clerkenwell*." [The address given in Vol. III., page 407, is Messrs. Gedge and Co., manufacturers of French Polishes, Varnishes, etc., 90, *St. John Street, Clerkenwell, E.C.* The part in which this information was given bears date July, 1884—two and a half years ago. I learn from Kelly's "London Directory" for 1886—to which you might have referred before writing to me—that Messrs. Gedge and Co.'s address is still precisely as given above. I have to thank you for telling me that there is really no such place as *St. John Street, Clerkenwell*. Kelly says otherwise, and so does my own personal experience; but bearing in mind what you tell me, I have no alternative but to doubt the one and distrust the other.—ED.]

Brass Fender.

ART STUDENT writes:—"A friend of mine, a blacksmith, wants to know where he can buy the fittings for making a brass fender with spindles complete, finished off, for fitting together ordinary sized fender, and also price of same. I suppose it will be the curb top and bottom and the spindles he wants, but, however, any information respecting it will oblige." [As regards the spindles, if your friend the blacksmith will turn a pattern or get a pattern turned for him, Mr. Gardner, *Wyvil Street, Wyvil Road, South Lambeth Road*, will cast them for him, and from Mr. Gardner he will doubtless get all the information he requires with reference to the curb, etc.—ED.]

Ivory Handle for Walking Stick.

P. B. (*Devonport*) asks:—Can any reader give me the name and address of a firm who make ivory walking-stick handles?

Automatic Fire Extinguisher.

F. S. (*Folkestone*) writes:—"Can you give me the address of a firm who are agents for a fire extinguisher (automatic patent). I have seen the announcement somewhere a while back. It is really water laid on to the top of the ceiling, and it comes on at a certain temperature."—[I do not know the fire extinguisher to which you allude, but possibly some of our readers do, and will help you.—ED.]

LETTERS RECEIVED UP TO JAN. 5.

GEOMETRIC (*Reply to query received too late for insertion this month*); S. W. O. (*Croydon*); ART STUDENT; H. H. B. C. S.; A. F. C. (*Bombay*); ESOR; A. K (*Bournemouth*); SKIDDAW GREY; A. M. O'D. (*Deniliquin, N.S.W.*); F. J. W.

BALCK'S GIRDER LATHE PLANER.

By JAMES LUKIN.

IN submitting to the reader a description of Balck's Planing Attachment to the lathe, I must in the first place state that the Britannia Company, of *Colchester*, have purchased the patent right, and are now the sole manufacturers. They have also in one or two details modified and improved it; rendering it much stronger and more efficient. It may be as well to say a few words as to what a lathe planer is intended to do, because I have heard disparaging remarks made about such tools, which show how little their capabilities are understood — a lathe planer is no more a planing machine than a fret-saw is a saw mill, or a rifle an Armstrong gun.

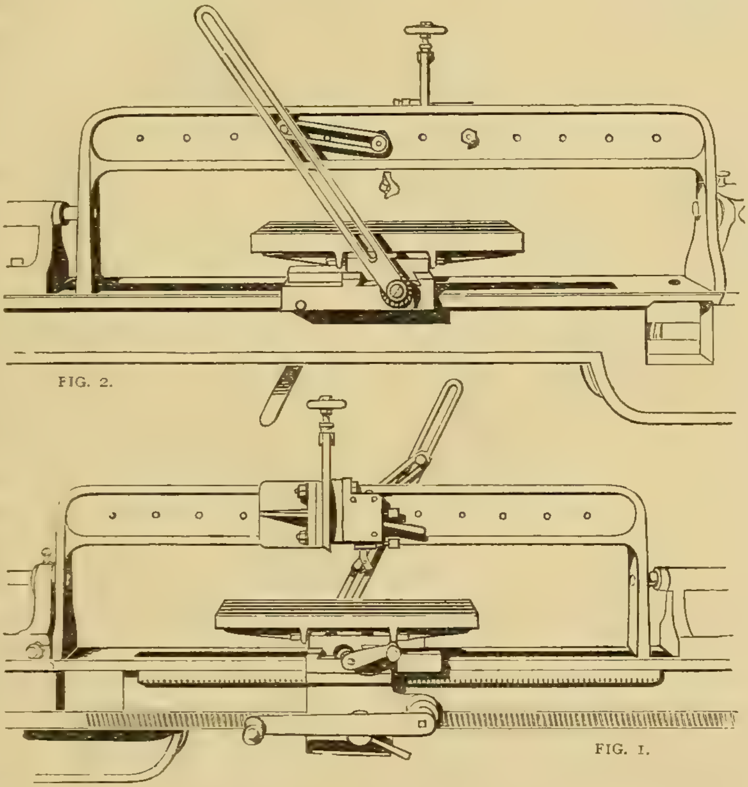


FIG. 2.

FIG. 1.

FIG. 1.—BALCK'S GIRDER LATHE PLANER, FRONT VIEW. FIG. 2.—BACK VIEW.

If an amateur is workman enough to make a 5-inch lathe, let us say, he would be very unwise to buy a planing attachment to plane such work as he is likely to undertake. A lathe planer labours under the usual disadvantages of combination machines. It is a makeshift, handy and efficient enough in its way, but its range of work is limited, and it will never be as convenient as a separate machine. It is the same with all lathe appliances, circular saw, emery wheel, fret-saw attachment, etc. They are not to be compared with such appliances, each on its own stand, and ready for use at any moment. Fitted to the lathe, they have one and all some weak point which it does not take long to discover, and, in addition, they are one and all more or less hurtful to a lathe if it is a first-class tool.

Although, therefore, I am always ready to speak well of a deserving candidate for amateurs' favour—and Balck's is unquestionably of this character—I am a strenuous advocate for separate machines in all cases where they can be had. In a well-fitted workshop you can turn from your lathe to grind a tool without displacing the work in hand, or you can plane a metal plate and bring it back to fit it to something that is in the chuck, and, if necessary, alter either without disturbing the other. Your circular saw will have a good large table instead of a little paltry affair standing on the lathe-bed, or in the socket of the rest, and as to the planer, it will not have to be modified or weakened, or clumsily arranged to enable it to accommodate itself to the lathe; but every part will be designed and fitted for the special work which a planer is intended to do.

But there are many amateurs who admire the ingenuity displayed in adapting one machine to do the work of another, and others have no room for separate machines, and too little cash to buy them, and it often happens that they have not work enough of a particular kind, such as planing, to demand a special machine. For these, therefore, a makeshift appliance is almost a necessity, and the chief question is, which of the many designs offered is likely to prove most serviceable.

Cheapest of all, costing two guineas, is my own invention, a planer hardly worthy of the name, but perfectly efficient for light work in brass or iron, and usable on the lathe-bed, the tool being held in the ordinary slide-rest. It is merely a square plate on which to clamp the work, which slides vertically up and down by a pump handle action. There is nothing simpler, and it can be had ready made in *Chelmsford*. I have no interest whatever in it, and it is not a patent. The vertical plate is the real secret,

and with such only can an ordinary slide-rest be used to hold the tool. With a gap bed it gives ample range for small work, and if desired, the plate can be worked by a pin in the driver chuck. I sent this to a mechanical contemporary, where it was, as I expected, duly snubbed, because it is not suited to plane the base-plate of a twenty-horse power engine, or the slide-valve of a Great Northern express locomotive. But there are such articles as the base-plate of microscopes, slide valves of model engines, guide-bars, and slides of ornamental chucks, and many other things, which an amateur cannot file up truly, and these it will do very well indeed.

But by the side of Balck's planing attachment it is a pigmy, and not worthy to lift up its head at all, and therefore I do not even send its carte de visite. Balck's is entirely novel in design, and is, I am sure, a very likely tool, well deserving the notice of our readers. He calls it a girder planer, and when I first saw the design, of which a drawing is given here, I rather shrunk from the idea of the girder, which I naturally felt would be a good handful, and a weighty concern to lift up and place upon the bed of a lathe. But when I saw the affair, and took up its girder in one hand, I was very agreeably surprised, for though stiff, it is very light indeed. This girder gives its name to the planer, and constitutes its novel feature. It extends the length of the bed, or nearly so, and is supported by the two headstocks—the mandrel nose entering a hole at one end, and the cylinder of the poppit a similar hole at the other, while at the same time, what forms the standards, rest on, and fit by, a tenon between the bearers. The makers now propose to add holding-down bolts to secure the girder in a more substantial manner. The object of this girder is to enable the tool-holder—here made double so that the tools cut in both directions—to be clamped at any part of it. The work is bolted to the saddle of slide-rest, the other part of it being made to serve as the tool-holder, but it is fitted with a swing tool-box that can be substituted at pleasure for the ordinary one. The saddle is operated by the rack and pinion, always attached to screw-cutting lathes, but here again, a specially strong rack is to be made use of, as otherwise there is some danger of breaking the cogs.

Although the Britannia Company have decided to do this, it was not the original intention of the inventor, whose object was to arrange a planer that would suit any one of the screw-cutting lathes without the necessity of alteration. All depends, as I have said, upon the proposed work. If this is to be such that tolerably heavy cuts are desired, it stands to reason that all parts of the machine must be strong and durable; but if it is to meet only the casual needs that arise in an amateur's workshop, then the ordinary rack should suffice, as was the original intention of the inventor. If a lathe must be altered to make the planer a success, the trouble and cost of alteration will militate against its use, and it is so good a machine in design that this would be a pity.

The arrangement is so evident from the illustrations, which represent the front view (Fig. 1), and back view (Fig. 2) of Balck's Girder Lathe Planer, as to need no special description beyond that already given. It is patented, and is not such as an amateur would be likely to undertake, as it can be made as cheaply, and far better by the Company who have arranged to manufacture it. It is of no use on any but a screw-cutting lathe, although it is proposed to alter the details so as to make it more universally applicable. As it now stands, without alteration or addition, it is a capital tool, and as an adjunct to the lathe, is probably the best at present in the market.

THE MAGIC LANTERN:

HOW TO MAKE IT AND USE IT.

By A PRACTISED HAND.

IV.—THE GAS-BAGS—HOW TO MAKE THE OXYGEN—THE OXY-CALCIUM JET—THE PRESSURE-BOARDS—THE LIME CYLINDERS—HOW TO USE THE OXY-CALCIUM JET.

THE GAS-BAGS are made in the shape of a wedge (Fig. 30), and, of course, vary in size according to the amount of gas that they are intended to hold. They are made thick and thin: the former may be used with any jet; but the latter should be used only with the oxy-calcium jet or with the safety jet, as the pressure required to be put upon the bag when working with either of these jets is not nearly so great as when the mixed gas jet is used. The thin bags are made of Jeanet india-rubber cloth, and are generally of a drab or putty colour; the thick bags are made of the stoutest twill india-rubber cloth, and are strong enough to stand a considerable pressure. They are, indeed, tested to stand a far greater pressure than you are ever likely to subject them to. A brass tap is fitted into the middle of the apex of all these bags, and it is by means of this tap that they are both filled and emptied. It is customary to speak of the bags by their cubical contents and not by their actual dimensions; but it is difficult to say exactly how much a bag of given dimensions will hold, because, in the first place, gas being compressible, it is hard to tell when the bag should be considered full; and, in the second place, as the sides and end of the bag swell out the more the bag is filled, it is not easy to determine its actual size. However,

it is not necessary to know the exact cubical contents of the bag: an approximate estimate will suffice

A bag	27 by 21 by 15 in.	will contain about	4	cubic feet of	gas.
,,	30 by 24 by 18 in.	,,	5	,,	,,
,,	36 by 24 by 24 in.	,,	8	,,	,,
,,	36 by 30 by 24 in.	,,	9	,,	,,

These are the usual sizes, and if the amateur intends to use different jets at different times, he had better get two of the larger thick bags; those of the capacity of nine cubic feet will suffice for an evening's dissolving view entertainment. One of these bags will be required for storing oxygen and the other for hydrogen or coal gas. The bags, once having been used for oxygen and hydrogen, must henceforth be kept for those gases. Hydrogen should never be stored in an oxygen bag, or *vice versa*. As the bags are alike it will be found advisable to paint a conspicuous O on the side of the oxygen bag, and an H on the hydrogen one, to distinguish them. The small bags alluded to above are intended to be used with a single lantern for a short entertainment: they are very handy for trying your jets and slides with, when arranging your apparatus for an evening's entertainment, as, of course, it would not do to waste the gas in your large bags for this preliminary "light up." One of the bags is shown in Fig. 30. As the bags get stiff in cold weather it is necessary to warm them before filling them. We must now see

How to make the Oxygen.—First be sure that the retort is clean and dry, and that there are no bits of straw, wood, etc., in it; then mix thoroughly together on a sheet of brown paper three parts by weight of chlorate of potash in crystals, and one part of black oxide of manganese in powder. Put the mixture into the retort (taking care that no foreign ignitible substance gets in with it), screw on the top, and stand the retort on a Bunsen's burner or on a clear fire; then connect it by means of the longer piece of india-rubber tubing with the A tube of the purifier (which should be from half to two-thirds filled with cold water), and put the other piece of tubing on to the B tube of the purifier. Roll up the bag as tightly as you can from the thick end, so as to expel the air—the tap, of course, being opened to let it escape. Then, while it is still rolled up, shut the tap, and then spread it out on a box or table so that it may be on a higher level than the purifier. The object of having it above the purifier is to prevent the water being forced into it by the rush of gas.

The water is often driven into the connecting tube, particularly if the purifier is too small or too full; but if the bag is raised it will run back into the purifier instead of being carried on into the bag. As soon as the gas is being freely evolved, which will be known by the quick bubbling in the purifier as well as by the pungent smell of the vapour escaping from the tube, you must slip the end of the tube on the tap of the bag, taking care to open the tap at the same moment.

The bubbling will continue and the bag will swell as long as any gas is being given off. The amount of gas that can be obtained from a charge of the mixture depends upon the quality of the chlorate of potash. No gas is given off by the manganese: its only use is to prevent the potash from evolving its oxygen too quickly. It might be washed from the spent charge and used over and over again; but as it is very cheap, and as washing and drying it is rather a messy job, it is scarcely worth while taking the trouble to do so.

In calculating the quantity of the mixture to put into the retort, you should allow one pound of chlorate of potash for every four cubic feet of gas. In theory, a pound of the best potash will yield five cubic feet of oxygen; but in practice, you will not get much more than four feet. A certain amount of gas is always lost by leakage at the connections, and a further amount is wasted in driving the air out of the tubes and purifier in the first instance.

The proportion of 1 part manganese to 3 parts chlorate of potash need not be strictly adhered to: many lanternists, indeed, mix them in equal proportions, while others put 1 part of manganese to 4 parts of potash, others again mix them by guess work, and it does not seem to make much difference in the amount of gas obtained. The only thing is, that if you do not put enough manganese, the gas may be evolved faster than the connecting tubes can convey it away, and the tube may be blown off the end of the retort; on the other hand, if you put too much manganese, the gas will be given off very slowly, and a greater heat will probably be required towards the end of the process. Again, it does not matter whether you use either or both of the substances in powder, or whether you have the manganese pulverized and the potash in crystals; in fact, you may use them any way you like: the great thing is to have them pure, and to make sure when mixing them that nothing gets in with them. I mention this again, because it is really very important.

When the bubbling in the purifier ceases, it is a sign either that the charge is spent, or that more heat is required to evolve the rest of the gas. If your bag is full, you know, of course, that the charge is spent, and you must then disconnect your retort from the purifier and remove it from the fire. Shut off the tap of the gas bag and stand it up. Empty the purifier, and when cool enough, wash out the retort. As the oxygen will not keep long in bags, it is absolutely

necessary that it should not be made more than a few hours before it is to be used.

Fig. 31 shows the oxy-calcium jet. It consists of a reservoir, A, connected by the tube, B, with the wick-holder, C. A second tube, D, parallel with the first conveys the oxygen to the burner. It terminates in a fine nozzle, which is turned towards the lime-holder, E. The tap, F, is for regulating the supply of oxygen, as it is important that the amount should be exactly proportioned to the size of the flame. The lime cylinder, G, shown immediately above the holder, fits on to the upright rod or pin, E, which screws into the horizontal bar, H. The reservoir, A, is a round flat tin box japanned on the outside, measuring 4⅝ in. by 1 in. One of the japanned tin boxes in which anglers keep their bait, might easily be turned into a reservoir ; in fact, any box will do, and it may be square or oval, larger or smaller than the size indicated above, and of tin or brass. A reservoir of the dimensions given will hold enough spirits of wine to last out an ordinary lecture. It is filled by removing the little ½ inch screw-cap, I, which has a pin hole in it to let in the air when screwed on. The tube, B, is a piece of ¼ inch brass piping 6 inches long, soldered into a hole in front of the reservoir. The wick-holder or cell, C, is made of a short piece of brass piping 1¾ inch long, and ⅞ inch in diameter. This is the usual size, but it may be either larger or smaller, and if the amateur has a piece of piping of a different size by him, he can use it. A piece of brass is soldered into one end to form the bottom of the holder, and the end of the tube, B, is soldered into a hole in the side. The wick-carrier of an ordinary spirit-lamp should be fitted into the other end to form a burner. This is the simplest way of making the burner, but if the amateur should not happen to have a spirit-lamp of suitable size, from which the top can be removed, he must make a burner. It consists of the four pieces shown in Fig. 32 : A is a little bit of ¼ inch brass tubing to hold the wick ; it fits into the opening in B, which slides loosely into the cell ; C is a brass ring fitting tightly into the cell, and forming a ledge or support for the piece B ; D is a screw-ring which is meant to screw into the cell over the B piece to keep it in its place. The oxygen tube, D, Fig. 31, is another piece of ¼ inch piping 14½ inches long. It passes under the reservoir and is soldered to it. One end terminates in the stop-cock, F, the other is bent as shown in the figure, and terminates in a fine nozzle. Suitable nozzles can be bought at most of the lantern stores ; they are made of brass, and are often tipped with platinum ; they screw into the end of the tube. The point of the nozzle should be on a line with the lime-pin, and ⅜ inch from the end of the wick-holder.

The lime-holder consists of a metal rod 2½ inches long, working in a collar either soldered direct to the upper part of the wick-holder, or sliding on a horizontal bar which is soldered to the wick-holder, the latter arrangement is shown in Fig. 33. A is the horizontal bar or support : it is of brass, and is soldered to the back of the wick-holder. A piece of stout brass wire bent into the form of a long U, the sides being parallel would do well. It should project about 1½ inch from the wick-holder. There are two little cross-pieces, B, C, to fit on to the support, one being placed above and the other below it. They are made to clench the bar (or wire) by means of the screw tube and thumbscrew, D, E, through which the lime-pin, F, passes. This keeps the lime in its place. A screw is cut in the tube, D, and a corresponding screw on the lime-pin, so that the action of turning the lime round raises or lowers it ; G is a small metal disc for the lime to rest on.

The support for the jet is shown in Fig. 34. It is a shallow tray made of tin and japanned. It slides in the grooves in the bottom of the lantern, and the jet is fixed to the upright rod, A. The tray is 5½ inches long by 4¼ inches wide, with a tongue soldered on to the bottom at each side: the rod is 5 inches long. The rod is firmly soldered to the bottom of the tray at one end, and near it is fixed the brass ring, B, by which the tray is pulled out of the lantern. The jet is fixed to the rod by means of the little thumbscrews, J, K, Fig. 31, which screw into the collar, L, on the tube, M. This tube is somewhat larger than the rod, and slides on it. It is soldered to the reservoir and to the two tubes, B and D. When secured to the rod, the jet should be perfectly horizontal. Our jet is now ready for use, but before trying it, we must get a pair of pressure-boards and some lime cylinders.

The Pressure-Boards are shown in Fig. 35. They are made of any light wood. You want two sets of boards, some 5 or 6 inches larger than your gas bag ; these boards are hinged together at one end with a pair of stout iron hinges. The boards are then opened, and the gas bag put between them, a semi-circular hole, A, having previously been cut out of the upper board midway between the hinges, to let the tap through. A ledge and flap, generally hinged on so that they may lie down flat when not in use, are required to support the weights by which the pressure is given to the gas. They are placed near the upper end of the top boards as shown in the figure.

The dimensions of the boards will depend, of course, upon the size of the bag which is to be placed between them ; it is better to make them too large than too small, as small bags may be used with large pressure-boards, though large bags should not be used with small boards ; in fact, except that large boards take up a lot of room, and are heavy and unwieldy, it

would not matter how large you made them. If you intend to use only small bags, pressure-boards measuring 32 inches by 26 inches will probably be found the most convenient; but, if you are going to give dissolving view entertainments, for which you will require large bags, you had better make full-sized pressure-boards, say 42 inches by 36 inches. Their construction is so simple that the amateur carpenter will find no difficulty in making them. The boards, the end of the lower one of which is hinged to the inner edge of a stout frame, B. This frame lies on the floor, and the boards are raised above it by means of the wedge or lever, A. If the boards are large, two levers should be used. C is a sheet of canvas to prevent the bags from touching; D, a strap for keeping the bags in their place; E, the ledge for the support of the weights; and F is the aperture for the taps.

If a set of pressure-boards should be wanted in a hurry, the top of a large packing-case can be used. It must be hinged to the floor or secured with hooks. An opening is cut out between the hinges for the tap, and a piece of wood nailed across it to form a ledge for the weights. But before putting your bag under the board you must make sure that there are no nails or sharp splinters of wood sticking out which could make a hole in the bag. If you should happen to make a hole in it you can stop it up temporarily with a piece of sticking-plaster, or, what is better still, a piece of an old india-rubber coat fastened over the

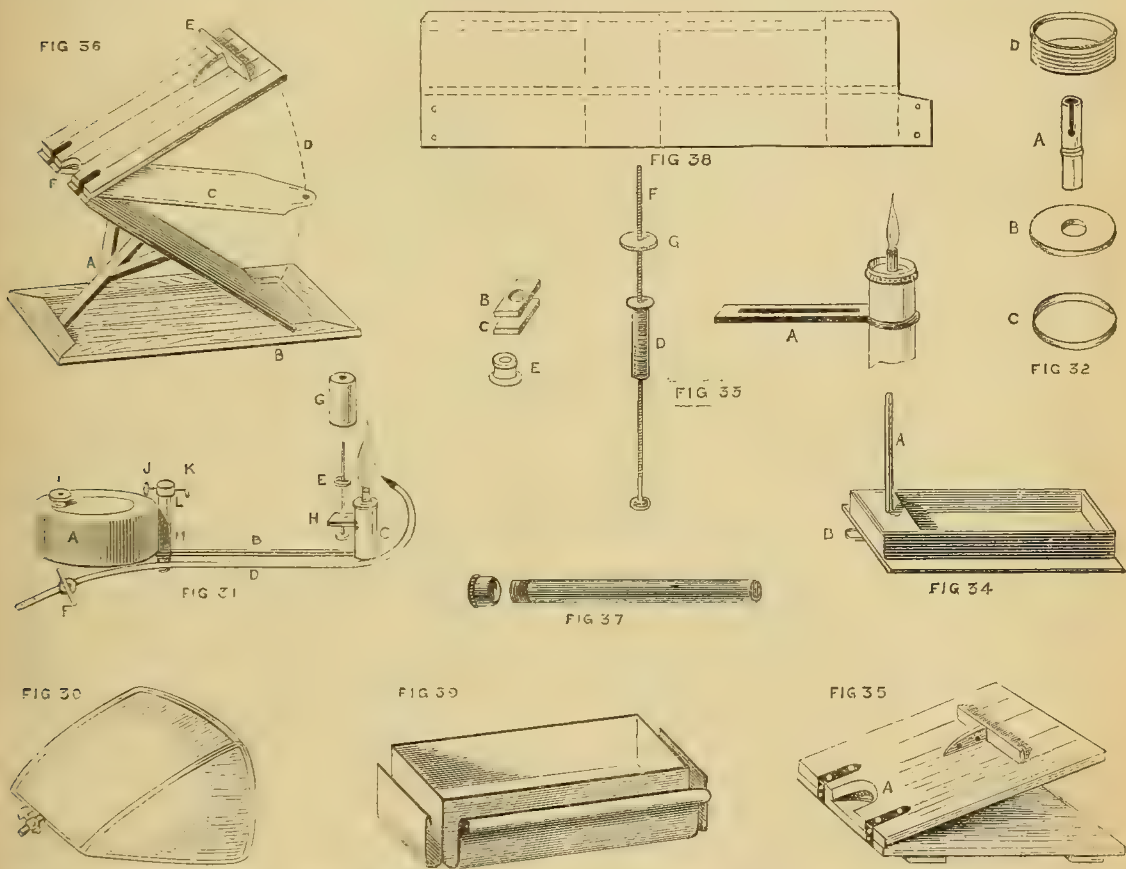


FIG. 30.—GAS-BAG. FIG. 31.—OXY-CALCIUM JET. FIG. 32.—PIECES COMPOSING BURNER. FIG. 33.—LIME HOLDER. FIG. 34.—SUPPORT FOR JET. FIG. 35.—PRESSURE-BOARDS. FIG. 36.—DOUBLE PRESSURE-BOARDS FOR TWO BAGS. FIG. 37.—LIME BOX. FIG. 38.—PLAN OF STAND OR HOLDER FOR CHIMNEY. FIG. 39.—HOLDER WHEN FINISHED.

double pressure-boards, Fig. 36, are for use with two bags. They are more convenient than two separate pressure-boards would be, and, of course, take up less room. One set of weights, too, suffices, and the pressure on both bags must be equal all the time the lecture lasts—a matter of no little importance, as we shall see later on. The bags are so placed as to feel the full effect of the pressure of the weights (which is not the case with the ordinary pressure-boards), so that less weight would be required to produce the same effect. The arrangement consists of a set of pressure-

hole with india-rubber solution. This last, if properly applied and allowed to dry thoroughly before pressure is put upon the bag, should last some time.

The Lime Cylinders (usually called the limes) are of two kinds, hard and soft. The former are intended to be used with the mixed gas jet; the latter are used with the oxy-calcium jet, and sometimes, but not always, with the "blow-through" jet. They are cut out of lumps of unslaked lime, and should be about $1\frac{1}{2}$ inch long and 1 inch in diameter: they have a hole up the centre about $\frac{3}{16}$ inch in diameter. The best way of making them is first to bore a hole in a piece of lime, then to cut out the cylinder as evenly as you can with a knife, and finally to turn it in a lathe, or if you have no lathe smooth off the edges with a file. The hard limes are generally a little smaller than the soft ones: the size, however, is of no consequence; but it is advisable to turn a number when you are about it, and to turn them all the same size, as then when you have adjusted your lime-holder you will not require to alter it when putting on a new lime. As lime has such an affinity for moisture, if the cylinders were left exposed to the air they would soon absord moisture from it, swell out, and fall to pieces. So that to keep them it is necessary to pack them up in damp-proof boxes or bottles. The usual way of storing them is to put a dozen into a wide-mouthed bottle or round tin box, and then to shake pieces of the same lime round them, filling up all the interstices with powdered lime, taking care to dry the powder thoroughly before putting it round them. The bottle must be corked up, and, as an additional precaution, you may seal over the cork. The boxes are soldered up or bound round with tinfoil. Sometimes each lime is wrapped up in tinfoil before it is put into the box; but if you want to keep them for a long time you should dip them in a preservative solution—the best is that made by dissolving common india-rubber in benzole. This solution must be kept in a stoppered bottle, and can be used again and again.

Chalk may be used as a substitute for lime if the latter cannot be obtained, and the amateur wants to "light up" in a hurry; but the chalk-light, if I may so call it, is far inferior to the lime-light, and, moreover, the chalk cylinders waste so quickly that they would be very inconvenient to use except as a last resource. The lime-box shown in Fig. 37 is handy for keeping a supply of limes in for immediate use. It is made of brass and has a screw-top. It can easily be made out of a piece of brass tubing large enough to hold six or nine limes placed end to end. A disc of sheet brass soldered into one end forms a bottom, and the top can be made either to screw or to slide on.

One thing more remains to be done before we can try our jet in the lantern, and that is, to make a stand or holder for the chimney. There is no necessity to make a chimney for use with the lime-light, as the telescopic lamp-chimney I described in a former paper will do. The holder can be cut out of a piece of sheet brass $10\frac{3}{4}$ inches by $2\frac{3}{4}$ inches. It is of the form shown in Fig. 38, and when put together, fits in the aperture on top of the lantern. The chimney rests in deep grooves formed by turning up the ends and sides of the strip as shown in Fig. 39. Three-quarters of an inch is allowed for overlapping, and the holder is fastened with rivets.

The jet can now be tried. First fix it to the upright rod on the tray, then put some cotton-wick into the burner and pour some spirits of wine into the reservoir. As soon as the wick is soaked, light it, and put a lime on to the lime-pin to warm; then run the tray into the grooves in the lantern, and, if necessary, alter the position of the jet on the rod so as to get the lime about on a line with the centre of the condenser. Now put your oxygen bag between the pressure-boards and connect it with the jet-tap by means of one of the lengths of india-rubber tubing. The tubing that you used in making the gas can, of course, be used, only you must be sure to see that there is no water in it. Turn off the jet-tap, put a $\frac{1}{4}$ cwt. on the ledge of the pressure-boards, and then turn on the bag-tap. Once turned on, this latter tap should not be touched while the entertainment lasts. Any alteration in the flow of oxygen that may be necessary is always made by the jet-tap. When you are ready to light up, turn the jet-tap slowly until the flame of the burning spirit is almost "killed." You will then have a very brilliant, steady, and pure white light not unlike the electric light, though not so powerful. There will probably be a dark shadow on some portion of the screen. This is owing to the light not being exactly in the centre of the condenser, and it is only necessary to move the jet one way or the other until you get rid of it.

Sometimes the pressure of the gas will be insufficient to enable it to overpower the flame, in which case an additional ten or twenty pounds must be put on the pressure-boards. In putting on weights lay them down very gently, otherwise the sudden rush of gas due to the increase of pressure will be very likely to extinguish the light.

As the lime gets pitted by the action of the gas it is necessary every now and then to turn it partly round so as to expose a fresh surface to the flame: a good deal of light is lost if this is not done. When it is pitted all round it should be removed and a new one put in its place.

(*To be continued.*)

PATTERN MAKING FOR AMATEURS.

By A. J. SCOTT.

V.—PULLEYS AND FLYWHEELS (*continued*).

IN our age of wrought-iron pulleys perhaps I may be doing wrong in describing the ordinary cast-iron one; still there being so many in daily use, and the simplicity of getting one cast induces me to give a brief description of the making of these pulleys. Certainly they are not so light as wrought ones; but those of the smallest sizes could not very well be relpaced by wrought-iron ones; and for the larger ones, that is in firms where they require a quantity, it would certainly pay to have wrought-iron pulleys, if only for the simple reason stated—lightness; but that does not mean all. They are generally better balanced than cast-iron ones, and that, combined with lightness, means less weight to turn round, therefore not requiring so much power.

But our amateur will, if I am not mistaken, require more cast pulleys than wrought iron, hence these remarks on their manufacture. Some of these remarks are taken from an American contemporary, in which a well-known correspondent under the name of "Chordal" writes. The ideas conveyed in his few remarks are the best practical suggestions, I believe, in print.

Sometimes after a man has made half a dozen pulleys he wonders why he did not follow some well-defined plan, so that they would all look uniform. For example, a man sits down to originate a pulley scheme, he fails, and tries again. He concludes the scheme to be wrong in some particular and works another. It simply, in plain language, amounts to this: When a man gets to wrestling with original pulley formulas he is almost in as bad a fix as the man who tries to find out the absolutely proper shape for a gear tooth—you may class them with perpetual motion, opium habits, etc.

The calculation of the proportion for a pulley will render useful the most abstruse mathematical possibilities. There are square roots, and powers, constants and factors, considerations of tension, and compression, torsion, and detrusion, modulus of elasticity, and I don't know what; and when you have fixed it all to a point, you will change it again in a month. At present no fixed proportion can be called accurate for a pulley pattern.

The object to be pursued with the best practical results is to put as little metal as is consistent with the strength required, leaving a good margin all over for theoretical strains. High-toned pulley shops are nicely fixed on the pulley question: they can have fine formulas and a different pattern for each condition; but the ordinary shops, nine out of ten, have no uniform pulleys, no original formulas, no special pulley trade permitting a multitude of patterns. Their patterns must be strong and light, and must be able to go into the foundry at a minute's notice, and to produce a pulley for any reasonable shaft.

The pulleys ought to look as uniform as hub changes will permit. I give here a formula which has no square roots in it, and will meet with the contempt of the refined few and the admiration of the many. I believe many places have adopted the table, and our amateur will do well to make his pulleys according to the table given herewith and formula given.

The arms are worked loose in each pulley, and the rims every foundry has always a good selection on hand, if not, our amateur had better build one up on his face-plate the thickness required, of which complete instructions will be given later on for this kind of work.

To set out the arms as in Fig. 72A we draw full size the diameter as shown at the dotted lines, divide circumference into six equal parts, as at A, A, A, A, A, A, at each of these points set at equal distances, using A as a centre, strike the points B and C on the circumference, whose diameter can be got from size given in table, column C. Strike a circle at centre of arms, taking size from column B in the table, shown at K, in Fig. 72A; next with A for a centre, strike arcs L and M, the radius being to each side of circle K, in Fig. 72A, midway between these arcs and the points B, C. Locate points P and Q with C as a centre, and A Q for radius, strike arc G; with B as a centre, and A P for radius, strike arc H; with C as radius sweep inside of arm touching circle K in centre of arm, and the radial centre being somewhere on arc G, with B H as radius sweep outside of arm touching circle K, centre being somewhere on arc H.

For straight arms, draw lines from centre circle K to points B and C on circumference, which will give outlines of arm. In order to get the semicircle I, you will require first the diameter of boss, which will vary according to the shaft. The dimension once being given, what is wanted, is, for supposition, I will take the diameter at the bottom of bosses to be 8 inches, and the thickness of arm to be ¾ inch, the diameter from the centre to the inside edge of I should be about nine inches, so as to leave a shade over a semicircle, when thickness of arm is worked, the fillet J kept about the proportion as shown, whose exact radius I will leave to the amateur's own judgment. For the section of arm in Fig. 73A, or edge view, you will be able from table to get the thicknesses in columns D and E. To get the proper outline for the cross section of arm shown in Fig. 74, you will want first two centre lines at right angles, from which to set out all curves; next draw circles A and B representing width and thickness of arm. Scribe points C top and

bottom from centre F, equal in distance from D to A; with D C for radius, describe the two sides of arm; for centre, E, you will want a semicircle, tying in the two lines already struck, showing a pure blended surface.

For the boss or hub pattern you will want, in addition to the ordinary boss, two facings turning on back to fit hole drilled or bored in arms shown in Fig. 75 by the dotted lines at A; and more completely in the facings at G.

From the table you can get all information regarding diameter and thickness, also size of core print required. For the description of Fig. 75, B gives the thickness taken from column I; D shows the print size from column J; for the diameter of boss I is taken from column H; the facing shown at F is merely for a couple of set screws if wanted, if not, you will require a key lining, as shown in my last article on pulleys, putting in its place. The thickness, C, at bottom of hollow, you will leave about an eighth of an inch thick, this is only necessary to save the pattern being broken during moulding. For the top boss you will require a recess turning out as shown, same size as core required, also a steady pin, A, the use of which I have explained in a previous article.

In reference to the making of a wrought iron pulley, I will give an article showing the manufacture and the necessary details at a future date, all being well, but at the present time I could not promise anything immediate: so that it would not do any good raising hopes which might be a time before being realized. From the above table of dimensions, giving some of the main sizes from 6 inches to 6 feet, you will be able to proportion all belt pulleys that I think an amateur can require; but before making it would be best to ask at a foundry if they have a pattern of the particular size he wants, if not, then our amateur had best make one; if they have, it will pay him best to let the foundry use their pattern. I give here a formula for proportioning pulley patterns.

FORMULAE.

A = Diameter of pulley.
B = Width of arms at centre of pulley.
C = " " at circumference.
D = Thickness of arms at centre of pulley.
E = " " at circumference.

All dimensions in inches.

B = A × ·0625 + ·5	C = A × ·04 + ·3125
D = A × ·025 + ·2	E = A × ·016 + ·125

Change decimal results to nearest sixteenths.

In my last article on rope pulley with single groove, I omitted to show my readers the moulding, and I must ask pardon for the omission. In Fig. 76 we have a view of what is generally termed a three-parted moulding box; you will see from the different sections where each joint is made. We will first suppose him to draw the top box away, marked A; now what is to hinder the moulder from drawing the patterns (that is, the top half of pattern) out of the mould? He will now lift his second box away, marked B, turn the box over, and draw the other half of pattern. You will perceive how easily this seeming difficulty is done away with in the art of moulding.

I will turn now to a little larger work, which the amateur may or may not ever have to do; but it sometimes happens that in the case of a breakage it will come in very useful. I intend to show the amateur how to make a fly-wheel for himself, as well as to show him how the larger rope pulleys are made with a number of grooves. By doing so he will get a better idea as to moulding in general, and if ever

TABLES OF PROPORTIONATE PARTS OF PULLEY ARMS AND HUBS.

Diameter of Pulley.	Width of Arms at Centre.	Width of Arms at Rims.	Thickness of Arms at Centre.	Thickness of Arms at Circumference.	Rim, Thickness at Centre.	Rim, Thickness at Edge.	Diameter of Hub.	Length of Half.	Diameter of Core.	Diameter of Shaft.
A	B	C	D	E	F	G	H	I	J	
inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.
6	$\frac{7}{8}$	$\frac{9}{16}$	$\frac{5}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{16}$	$2\frac{1}{4}$	$1\frac{1}{4}$	$\frac{3}{4}$	1 to $1\frac{1}{4}$
10	$1\frac{1}{8}$	$\frac{11}{16}$	$\frac{7}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{16}$	$2\frac{5}{8}$	$1\frac{1}{2}$	$1\frac{1}{8}$	$1\frac{5}{16}$—$1\frac{1}{2}$
12	$1\frac{1}{4}$	$\frac{13}{16}$	$\frac{1}{2}$	$\frac{5}{16}$	$\frac{5}{16}$	$\frac{3}{16}$	$3\frac{1}{8}$	$1\frac{3}{4}$	$1\frac{1}{4}$	$1\frac{9}{16}$—$1\frac{3}{4}$
14	$1\frac{3}{8}$	$\frac{7}{8}$	$\frac{1}{2}$	$\frac{5}{16}$	$\frac{5}{16}$	$\frac{3}{16}$	$3\frac{5}{8}$	2	$1\frac{1}{2}$	$1\frac{13}{16}$—2
18	$1\frac{5}{8}$	1	$\frac{5}{8}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{4}$	4	$2\frac{1}{4}$	$1\frac{3}{4}$	$2\frac{1}{16}$—$2\frac{1}{4}$
24	2	$1\frac{1}{4}$	$\frac{3}{4}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{1}{4}$	$4\frac{1}{2}$	$2\frac{1}{2}$	2	$2\frac{5}{16}$—$2\frac{1}{2}$
28	$2\frac{1}{4}$	$1\frac{7}{16}$	$\frac{7}{8}$	$\frac{9}{16}$	$\frac{3}{8}$	$\frac{1}{4}$	5	$2\frac{3}{4}$	$2\frac{1}{4}$	$2\frac{9}{16}$—$2\frac{3}{4}$
36	$2\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{1}{8}$	$\frac{11}{16}$	$\frac{7}{16}$	$\frac{5}{16}$	$5\frac{1}{4}$	3	$2\frac{1}{2}$	$2\frac{13}{16}$—3
40	3	$1\frac{7}{8}$	$1\frac{3}{16}$	$\frac{3}{4}$	$\frac{7}{16}$	$\frac{5}{16}$	$6\frac{3}{8}$	$3\frac{1}{2}$	$2\frac{3}{4}$	$3\frac{1}{8}$—$3\frac{1}{2}$
44	$3\frac{1}{4}$	2	$1\frac{5}{16}$	$1\frac{3}{16}$	$\frac{7}{16}$	$\frac{5}{16}$	$7\frac{1}{4}$	4	$3\frac{1}{4}$	$3\frac{5}{8}$—4
48	$3\frac{1}{2}$	$2\frac{1}{4}$	$1\frac{7}{16}$	$\frac{7}{8}$	$\frac{1}{2}$	$\frac{5}{16}$	$8\frac{1}{4}$	$4\frac{1}{2}$	$3\frac{1}{4}$	$4\frac{1}{8}$—$4\frac{1}{2}$
60	$4\frac{1}{4}$	$2\frac{11}{16}$	$1\frac{11}{16}$	$1\frac{1}{16}$	$\frac{9}{16}$	$\frac{7}{16}$	9	5	$4\frac{1}{4}$	$4\frac{5}{8}$—5
72	5	$3\frac{1}{8}$	2	$1\frac{1}{4}$	$\frac{5}{8}$	$\frac{1}{2}$				

SUPPLEMENT PRESENTED with "AMATEUR WORK, ILLUSTRATED." Part 64. March, 1887.

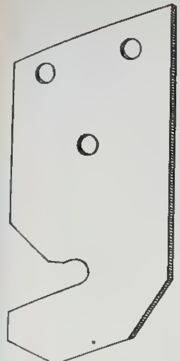


Fig. 8.

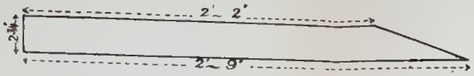


Fig. 3.

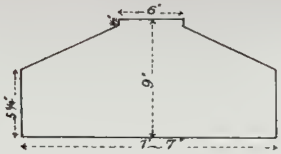


Fig. 4.

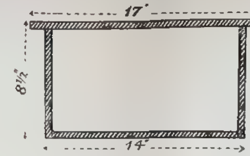


Fig. 13.

Fig. 7.

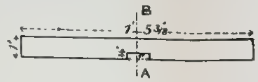


Fig. 5.

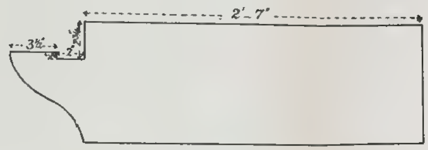


Fig. 6.

Fig. 10.

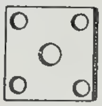


Fig. 9.

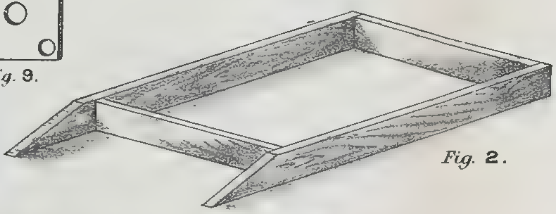


Fig. 2.

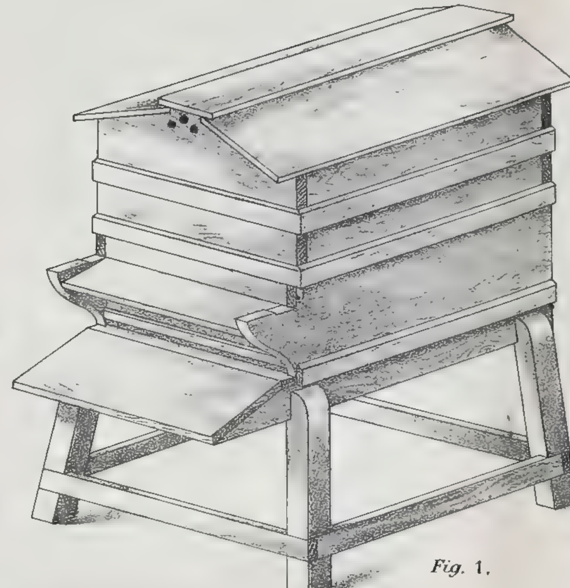


Fig. 1.

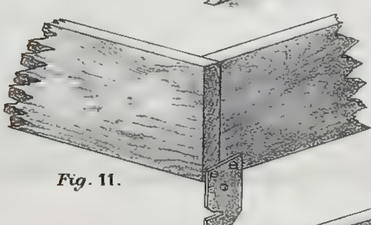


Fig. 11.

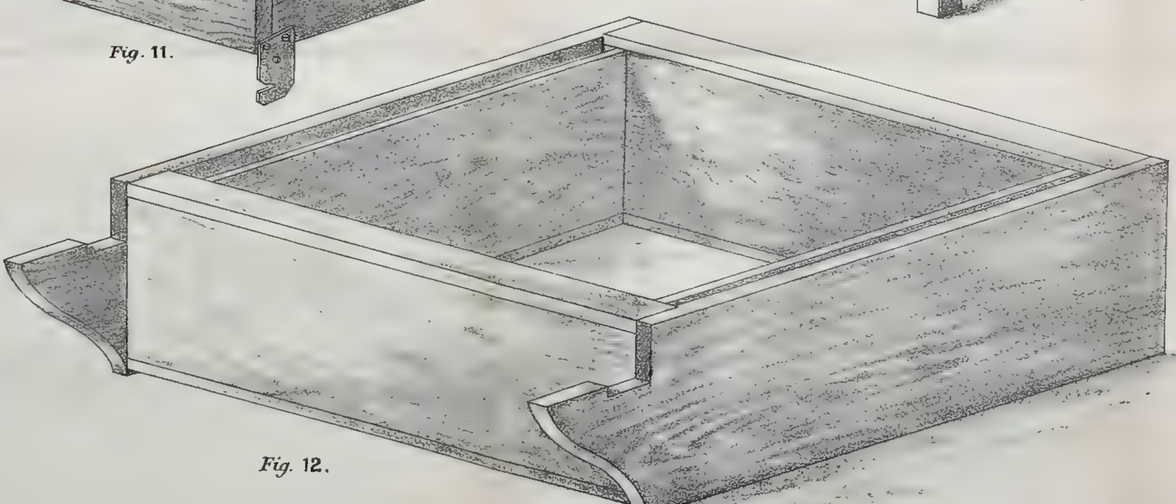


Fig. 12.

A HANDY BEE-HIVE FOR AMATEUR BEE-KEEPERS.

DESIGNED and DESCRIBED for "AMATEUR WORK, ILLUSTRATED." By WALTER J. STANFORD.

Fig. 1.—General View of Hive.
,, 2.—Skeleton of Floor Board.
,, 3.—Plan of Long Side of Floor Board.
,, 4.—Plan of Short Side of Roof.
,, 5.—Plan of Door, to be cut along A B.

Fig. 6.—Plan of Long Side of Brood Nest.
,, 7.—Section of Piece that Doors run in.
,, 8.—Plan of Hinge.
,, 9.—Plan of Screw Plate.

Fig. 10.—Elevation of Screw.
,, 11.—Corner of Riser, with Hinge on.
,, 12.—View of Brood Nest.
,, 13.—Section of Frame.

SCALES.—Figs. 1, 2, Isom. Scale, 1½in. = 1ft. Figs. 3, 4, 6, 13, Nat. Scale, 1½in. = 1ft. Figs. 5, 7, Nat. Scale, 3in. = 1ft. Figs. 11, 12, Isom. Scale, 3in. = 1ft. Figs. 8, 9, 10, Full Size.

FIG 73 A

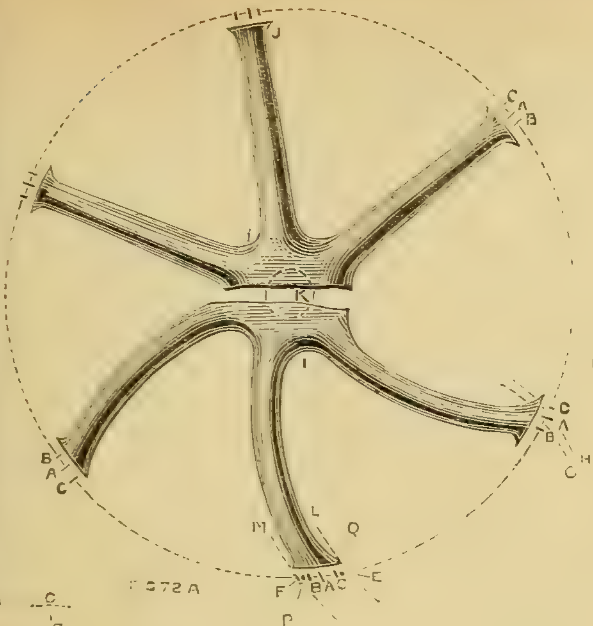


FIG 72 A

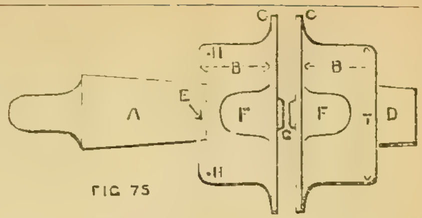


FIG 75

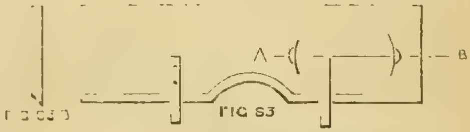


FIG 83

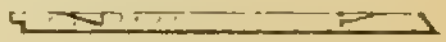


FIG 83 A

FIG 81

FIG 84

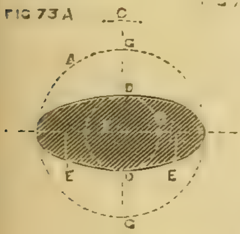


FIG 74

FIG 82

FIG 76

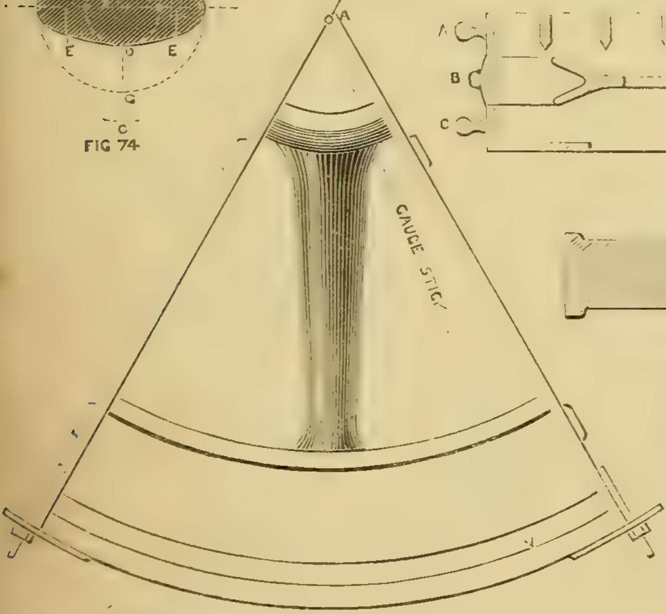


FIG 80

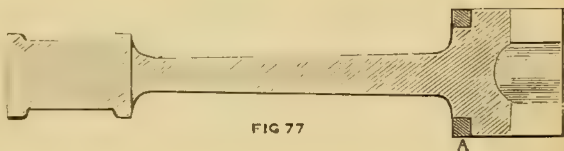


FIG 77

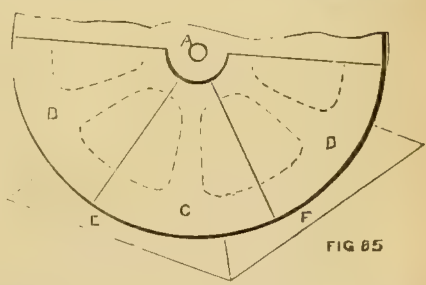


FIG 85

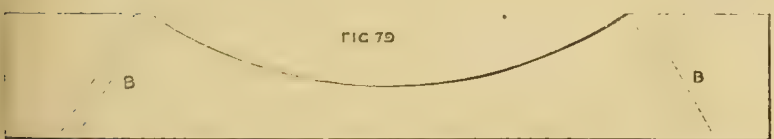


FIG 79

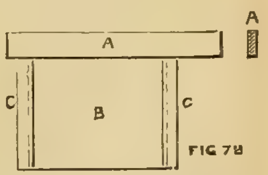


FIG 78

FIGS 72A, 73A, 74.—PULLEY ARMS, 36 INCHES IN DIAMETER, 1/8 SIZE. FIG. 75.—BOSS OF PULLEY. FIG. 76.—THREE-PARTED MOULDING BOX. FIGS. 77, 80, 81.—FLY-WHEELS MOULDED FROM CORE BOX. FIGS 78, 79.—ARM CORE BOX. FIG. 82.—GAUGE STICK. FIG. 83, 83A, 83B.—CORE BOARD. FIG. 84.—CORE PRINT. FIG. 85.—MODE OF SETTING CORES ROUND MOULD.

called upon, the knowledge will come in very acceptably. Of course we must give it as a limit that in this magazine all must be amateur work, and what amateurs can make; but I myself find it very hard sometimes to draw the line, as each man has some particular hobby, and the work he turns out with so much practice will compete with any professional, so the reason for bringing these remarks before you.

I must, however, pass on to Fig. 77, which shows section from centre to circumference of an ordinary fly-wheel, which may, however, be utilised as well for a belt pulley as shown. A is a wrought-iron hoop round boss to strengthen after its being split in casting.

To make the pattern you will first want an arm core box (if the wheel is not so large, say over 2 feet, it is best to make a complete pattern) as shown in Fig. 80. We will suppose it is required to have six arms in flywheel, therefore we must have the sides of the arm box, making an exact sixth of the circumference, or at 60°; the sides must be the same depth as the distance through the thickest part of wheel, which in this case would be the boss, therefore the width must coincide in each case. Screw the end into place, and after drill a hole with a centre-bit; next fit a hard wood pin in its place, at the centre shown at A, Fig. 80. Complete instructions for making this box will be given in the next article.

To mould this pulley the moulders will strike up a level bed in the foundry and erect an iron spindle in the centre, shown at A, Fig. 85. The gauge stick is shown at Fig. 82, whose length from the centre of semicircular hole cut in end is equal to radius of arm core-box, this so-called gauge stick is used for setting the cores round mould, shown more fully in Fig. 85: A representing spindle; B, C, D, arm cores; E, F, cores, whose inside edge is a planed surface, and whose duty it is to fill up the rim recess left by the arm core-box. The number of these cores is not particular, so they are a nice handling length, and are equally divided round the circumference. The manner of making this box is shown in Figs. 78 and 79. Fig. 79 really shows the section of rim belonging to flywheel, and also method of construction; in brief, it is really a block of rectangular section cut to the same radius as the wheel, and the small facings on either side, as shown, fitted and screwed on afterwards, not cut out of solid. This is shown by the dotted lines. Fig. 78 representing end view, A being an ordinary straightedge or strickle, as a moulder will call it, its use being to draw along over sides as shown, so as to leave the core quite straight across. B shows the ends of box, which are rebated in the sides C as shown, perhaps about a quarter of an inch. The letters are the same in both instances. The sides want planing straight and out of wind, and if of long length will want battens screwing on to keep them true, something after the style of the arm box sides shown in Fig. 80. For the ends you must not forget to run the grain of timber battens crossway, so that the sides will screw in sideway of grain for additional strength, as screws don't hold so well endway of grain. You may fasten a length of timber about two inch section into each of the outside angles for battens; by this means there can be no loosening of box during core-making. Fig. 84 shows the core print; you will perceive a hole in centre, this is cut out same size as centre spindle used, and is slipped over spindle and bedded in sand, generally the spindle used is $1\frac{3}{4}$ inch in diameter. Fig. 83 shows what we call the core-board, which is an ordinary piece of wood in this case about one inch timber, and, say, a foot longer at either end than core required. It is worked to shape of core, and is then bevelled all along its edge like Fig. 83B. This core being made on a barrel, the board is bevelled so as to cut the loam during the core revolving. To cut it off to its correct length you fasten two short strips as shown. Fig. 83A shows section through A and B, which you will have to cut as shown in section, the distance across the niches being size of core required, the core-maker then sets his callipers to these niches, and thus saves him time measuring, and also taking the responsibility as to size from him on to the patternmaker.

(*To be continued.*)

BEE-HIVES AND BEE-FURNITURE.

By WALTER J. STANFORD.

(*For Illustrations see the Folding Sheet issued with this Part.*)

I.—When to Start Bees—The Hive—Materials—How to Build Hive—Floor Board—Legs—Brood Nest—Dimensions of Hive—Riser and Roof—Hinges—Porch—Ventilation—Painting.

IN these days of advancing bee-keeping, a writer unknown to the English bee world, naturally feels rather shy about taking up this subject, and presuming to advise would-be apiarians as to the best appliances to make or invest in. However, as a carpenter and a successful bee-keeper, I determined some time ago to take the subject in hand for Amateur Work. Moral philosophy teaches us that no sooner has a man acquired knowledge, than he burns to impart it to his neighbours; and I suppose I am no exception. I have for the last year, therefore, been taking notes from various sources, notably, bee shows, "The Bee Journal," and "Cowan's Book on Bees," with the intent of persuading fellow-labourers to take up this undeniably profitable pursuit. To

Mr. Cowan's book, especially, I must own myself indebted for my success in the science—for such it really is—and for many practical hints for this article; and let me beg all who are thinking of "setting up" to invest in this book—"The British Bee-keeper's Guide Book," by T. W. Cowan, F.G.S., F.R.M.S., etc., published by Houlston and Sons, *Paternoster Square*, at 1s. 6d.

The names of the two hive-makers I mention in these papers are the only two I have had personal dealings with, and I can thoroughly recommend them both for quality and price; but at the end of Cowan's book a splendid list of local dealers will be found, so choose for yourself. My man for England is S. J. Baldwin, The Apiaries, *Bromley, Kent*, and for Ireland, Messrs. Edmondson, 10, *Dame Street, Dublin.*

Although we can all *keep* bees, everyone is not successful with them. Energy and great perseverance are essential to making money by them. Many men have started in great spirits, but in a short time have given them up, from simple indifference to ordinary reason. If a man, who owns some grassland, buys a quantity of stock, turns them loose, leaves them to their own resources, and comes again in a year's time expecting to reap a huge profit, he is liable to be disappointed—so with bees. But if you will work for them, they will work with interest for you, and bring you in more pocket-money than any other similar occupation possibly could. As my paper is intended to embrace bee-furniture only, and not bees themselves, I shall only touch on their habits, where it is necessary to show my reason for adopting any special form or size of structure.

The best time to start bees is either late in summer or early in spring, but we must first have something to put them into—in other words, we want a hive. Wooden hives are by the leading scientists agreed to be the best for profit, and so to the wooden ones I have devoted myself almost entirely. The hive I am about to describe is a first-class and handy one, on the principle of Baldwin's "Dublin" hive. It has carried off first prizes in every direction, and is largely used by a great many bee-keepers. Fig. 1 shows an engraving of it to scale (isometric), but as I shall mention every necessary dimension on paper, you needn't trouble yourself much about the scales, though I have taken great trouble to make them very accurately. First choose what timber you will use. Yellow pine is the best on account of its great durability under various trials, and also bees are supposed to like it best, though how they have shown their liking for it I have never yet heard. But as pine is, on account of its great cost, against the principle of beginning cheaply, good red, or even first-class white deal will answer the purpose almost as well. I have made my hives of a mixture of pine and red and white deals, only putting pine in places where I consider exceptionally good wood necessary. If you order—Three 12 ft. by 11 in. by $\frac{3}{4}$ in. 1st red deal; one 12 ft. by 9 in. by $\frac{1}{2}$ in. 1st white deal; one 7 ft. by $2\frac{1}{4}$ in. by $2\frac{1}{4}$ in. 1st white deal; one 12 ft. by 9 in. by $\frac{1}{2}$ in. 1st yellow pine; you will have rather more than enough to make one of these hives.

We will start and build upwards, and must therefore attack the floor board and legs first. As the size a hive should be is a disputed point, I shall give further on my reasons for adopting these special dimensions, but we will take them for granted for the present and build the stand to take a hive of outside dimensions 25 inches by $18\frac{5}{8}$ inches. Fig. 2 shows the skeleton of the floor board in isometric projection. To start at it, divide the 11-inch width of a red board into four, and cut out two pieces 2 feet 9 inches, and two $17\frac{3}{4}$ inches long. Square them up, carefully cleaning off each long side to the dimensions shown in Fig. 3, nail it up as Fig. 2, when it should be 18 inches full outside width. Again, out of the red stuff cut sufficient timber to make the floor and the sloping alighting board. Make glue joints, ploughed and tongued, for the floor board, and make a good joint for the bevel piece. Nail on the floor, and make a whitelead joint for the alighting board; nails should be punched in well. It is advisable to use nothing but wire nails, or French nails as they are often called, throughout the hive, boring for every nail to avoid the risk of splitting. At the bottom underside of the alighting board a throat must be run, *i.e.*, a ploughed cut about three-eighths of an inch from the lower edge, and about one-eighth of an inch deep, to throw off the rain. Pass a straightedge in every direction over the floor board, and make it truly level.

The legs to support this must now be made, and they may be troublesome unless care is taken. I will, however, try and simplify the work by going rather into detail. Cut four pieces 19 inches by $2\frac{1}{4}$ inches by $2\frac{1}{4}$ inches white deal. Plane and square them up all round. Fig. 1 shows the legs with the floor board fixed, and looking at it, it is, I think, evident that the legs splay out in every direction. This is a necessary precaution to guard against any risk of the hive ever getting blown over. We must now get approximately the angle of splay, and having set our "bevel" to it, use the bevel so set, instead of a square to mark the legs. The outside dimensions of the legs at the top to fit the floor board must be 24 inches by 17 inches, and allowing 4 inches splay; the outside dimensions on the ground will be 28 inches by 21 inches. Now take any scrap piece of wood

about two feet or so long, and roughly plane up one side, shooting one edge also fairly straight. Take one of the legs and lay one of its sides fair along this edge, and with a pencil mark the point of the top and bottom corners. Keeping the top corner exactly in position as a centre, move the leg inwards till it is 2 inches away from the edge ; fix with a pencil the *point* of the bottom corner in its new position, and set the bevel to pass through these two bottom points. Screw it carefully to that angle. Take the four legs and stand them up on the finished floor board at the four corners, and number them 1, 2, 3, 4 ; numbering similarly the corners on which they stood. Take one of the legs, say the left-hand front corner one, and write "Front outside, Inside front, and Inside outside," on the four sides, calling "front" and "outside" the faces you would see if standing on the front and one side of the hive respectively. Mark the other legs similarly. As is seen by Fig. 1, a 2 inch by $\frac{3}{4}$ inch strip is let in all round, 3 inches from the bottom to give extra strength. It could be simply nailed on, but it is a much stronger and neater job when let in. Great care must be taken in marking the lines for the necessary cuts ; but if you remember always to use the set bevel and to mark from one of the insides, I don't think a mistake can be made. The floor board is, for better support, let 2 inches by $\frac{3}{4}$ inch into the legs. The cut for it can just be seen in Fig. 1. As soon as the legs are all ready cut the necessary battens, nailing the longer ones on first, so that no ends may appear in front. Care must be taken before this that the legs are all the same length, and in nailing up to have the outside span at the bottom approximately correct ; also before nailing up it would be well to round off the top outside corners, as shown in Fig. 1, for appearance' sake. Put the floor board in its place, and drive one screw into each leg from the inside ; and the stand is finished.

The next thing to be made is what we will call the brood nest. The whole principle of what old bee-keepers call "the new-fangled hives," is that every comb is completely movable and under the control of the owner. To effect this, some sort of frame must evidently be used. As it is a most essential point in a well-managed apiary to have every frame of exactly the same size, so as to be able to help weak colonies from the stores, etc., of stronger ones, the British Bee-keepers' Association a few years ago adopted a frame of a certain shape and dimension, which they called the "Association Standard Frame." Fig. 13 shows a section of it with the outside dimensions, *i.e.*, 14 inches by $8\frac{1}{2}$ inches, the top bar being 17 inches long and $\frac{3}{8}$ inch thick, while the bottom bar is $\frac{1}{8}$ inch, and the sides $\frac{1}{4}$ inch thick respectively, the width being $\frac{7}{8}$ inch all round. But for general use a slightly stronger frame is desirable; and as the outside dimensions is the primary object to maintain interchangeability, I always make my top bar and sides out of $\frac{1}{2}$ inch pine (planed up), and the bottom bar about half that thickness.

Now bees are very exact measurers, and, therefore, hate to have more or less room than they require. It has been found by experiment that the exact space a bee likes to have to move about in is $\frac{1}{4}$ inch. If you give her more she builds comb in it, and if less she fills it up with a resinous substance called propolis, obtained from buds and limbs of trees, especially from the horse-chestnut and different kinds of pine, and with it they seal up every small corner about their hive. If, therefore, you allow the bees either to build comb or propolize by bad measurements, the leading object of these hives, namely, having the frames movable, will be defeated.

Once more, it has been found that bees build their comb about seven-eighths inch thick, and to find what space must be left between two frames, we must add to this $\frac{7}{8}$ inch two $\frac{1}{4}$ inch, $\frac{7}{8}$ inch + $\frac{1}{2}$ inch = $1\frac{3}{8}$ inch; but that has been found on the average barely sufficient; and so $1\frac{9}{20}$ inch or nearly $1\frac{1}{2}$ inch is the space that has been adopted from centre to centre of comb. Various methods are used for keeping the frames at this distance apart, but the only two workable ones (*mea sententia*) are the "broad-shouldered" and the "distance pin" methods, of which the latter method is, I think, far and away the best ; but in my next paper I hope to deal fully with frames, and to give everyone an opportunity of choosing for himself.

This seeming digression has been a roundabout way of getting at the internal dimensions of a hive, which we can now proceed to calculate. The width and depth of our hive is compulsively fixed by the standard frame, viz., 14 inches + $\frac{1}{2}$ inch = $14\frac{1}{2}$ inches for the width; and $8\frac{1}{2}$ inches + $\frac{1}{4}$ inch + $\frac{1}{8}$ inch = $8\frac{7}{8}$ inches for the depth, allowing $\frac{1}{8}$ inch for warm coverings on the top of the frames.

The length of the hive depends on the number of frames required, and this is, and always will be, more or less a disputed point ; but the leading bee-men are agreed that one queen can't keep more than twelve frames going (some say ten is enough), but I prefer twelve ; and if, besides these, we leave space for two dummies, or plain pieces of boards to contract the brood nest when necessary, we shall get $20\frac{3}{4}$ inches as the inside length necessary. So the total inside dimensions are, $20\frac{3}{4}$ inches by $14\frac{1}{2}$ inches by $8\frac{7}{8}$ inches. But as the top bar of the standard frame is 17 inches long, we shall have to make the inside width at least 17 inches at the top, and pack up to $14\frac{1}{2}$ inches for the main part of the nest.

Now bees are very sensitive creatures, and are

very susceptible to either great heat or great cold, and we must therefore help them to maintain, if possible, a constant temperature in their hive. Evidently the best way to do this is to interpose some non-conductor between them and the outer air. Of such non-conductors, an air-tight space is undoubtedly the best; but as this requires better workmanship than most amateurs can put on, and as cork-dust packing is almost as good, I prefer to leave a space and pack it with this cork-dust, which is easily got for nothing from any grocer or importer of grapes. We have decided to make the inside of the brood nest $20\frac{3}{4}$ inches by $14\frac{1}{2}$ inches, so to fit the floor board already made, the outside dimensions of the whole thing must be 25 inches by $18\frac{5}{8}$ inches. If we make a case of $\frac{3}{4}$ inch stuff (which will plane up to $\frac{5}{8}$ inch) 25 inches by $18\frac{5}{8}$ inches outside, the inside dimensions will be $23\frac{3}{4}$ inches by $17\frac{3}{8}$ inches, and if we pack this inside with $\frac{1}{2}$ inch stuff planed on one side up to $20\frac{3}{4}$ in. by $14\frac{1}{2}$ in., we shall exactly get a clear space of 1 inch all round for packing, which will be ample.

Now, to construct this out of the $\frac{3}{4}$ inch red, cut the two long sides as shown in plan, Fig. 6 (the use of the bracket will be seen afterwards), particular care being taken to make the position of the bracket exact. Cut out one of the two short sides $17\frac{3}{8}$ inches by 8 inches, and the other $17\frac{3}{8}$ inches by $7\frac{3}{4}$ inches. This difference of width is necessary, so that by putting the narrower piece in front, we can form an entrance of $\frac{1}{4}$ inch for the bees. The exact length of this short side, will, of course, vary a little, the first object being to have the outside width $\frac{1}{8}$ inch more than that of the floor board. Now nail it up, so that both short sides come within about $\frac{1}{2}$ inch of the top of the long sides. Three 2 inch wire nails dovetailed in will be sufficient for each corner. The nail nearest the top should be at each front corner quite $1\frac{1}{2}$ inch away from the top, so as to avoid a collision between it, and a screw which has to go in about there afterwards.

Now proceed to make the inch space. Cut two pieces of $\frac{1}{2}$ inch white deal, *exactly* corresponding to each of the short sides of the box, and by nailing them to 1 inch by $\frac{3}{4}$ inch strips, which can be nailed to the long sides in each corner, we shall get a space of 1 inch at the back and front; the top and bottom of these pieces should correspond with those of the back and front of the box.

Fig. 12 shows the brood nest finished to an isometric scale of 3 inches to 1 foot, in which a sort of trough is shown running along the long sides inside, with a bevelled edge above it. On this edge the frames will rest, and the object of the bevel is to minimize propolization; the trough gives room for any bees which may wander during manipulations, to pass under the frame ends and crawl into the hive again, instead of being squashed. The level of this trough should be about $\frac{7}{8}$ inch below the top of the long side, and the top of the bevelled edge a full $\frac{1}{2}$ inch below the same. If good measurements have been made, the inside length of the hive should be now $20\frac{3}{4}$ inches; so cut two pieces of $\frac{1}{2}$ inch stuff, $20\frac{3}{4}$ inches by 8 inches. Also cut two strips $20\frac{3}{4}$ inches by 1 inch, and with three $1\frac{1}{2}$ inch nails fasten these two strips to the long side to form the trough. Under them nail four 1 inch wide pieces in the corners to fasten the double walls, for the long sides too. Bevel the top edge of these walls to any angle, and nail them on, keeping the level of the bevel edge $\frac{1}{2}$ inch below the top; their bottoms should be flush with the walls of the back short side. With pieces of 2 inches by $\frac{1}{2}$ inch stuff, cover over the inch space of the front and back; turn the whole thing upside down, and pack with cork-dust all round, ramming it down well.

Now cover over these four spaces, doing the front and back first with pieces similar to those used for the upper side. There should now be a $\frac{1}{4}$ inch entrance the whole way across in front. The top bar of the standard frame is 17 inches long; but if you lay a rule across from side to side, the distance will be found to be $17\frac{3}{8}$ inches. The difference must be made up by two thin strips glued on.

To cover the joint of this brood nest with the floor board, cut out of $\frac{1}{2}$ inch yellow pine two pieces 25 inches by 2 inches, run a bevel along one edge and nail them to the long sides with white lead, dividing them equally between the floor board and nest, *i.e.*, the centre of the strips should be on the line of junction. The bevel is necessary to throw off the rain. A similar piece must be cut for the back. The brood nest is now finished all but the porch and doors, which can be put on afterwards. All the internal joints should have been made as good as possible. Use few nails and punch them all in; most of them can be puttied when the first coat of paint is on.

We next come to what I call the "riser," and the roof. It is a well-known fact that bees will store and finish off better and cleaner honey in an upper story than they will in the brood nest. We must, therefore, give sufficient upstair room for receptacles for this super honey, as it is called. There are two usual forms in which honey is taken from bees—viz., comb honey and extracted, or run honey. To take comb honey, we supply the bees with little boxes or sections to fill. The two sizes of section in common use, are the two pound size measuring outside $6\frac{1}{4}$ inches by $5\frac{1}{4}$ inches by 2 inches, and the one pound size measuring $4\frac{1}{4}$ inches by $4\frac{1}{4}$ inches by 2 inches. As the one pound size is far and away more saleable than the bigger ones, most bee-keepers use nothing else, and I shall deal chiefly with them, though I hope to

deal more fully with both sizes later on. As in the height of the season, a good stock will require at least two layers of the small size, to keep them occupied, we must leave full 9 inches space for section supering above the brood nest. This size, as will be seen afterwards, is also about what is wanted for extracting purposes. With this size in view, we can start at the riser. Take one of the 11 inches by ¾ inch red boards, and rip about 8 feet of it down the centre. Out of the half-pieces, make an ordinary box of outside dimensions about ⅛ inch larger than those of the brood nest. For appearance' sake, it is better to let the short sides run the full width of the brood nest, so as to cover the ends of the long sides in front. Make a good joint between this riser and the brood nest.

In all good hives now, the roof and riser are hinged to the brood nest for convenience when manipulating, while at the same time they should be easily removable if wanted. I have therefore got a special kind of hinge from Baldwin, for which he charged me tenpence a pair, screws and all complete; but as some of us are blacksmiths, I give Figs. 8, 9, 10, drawings of the three parts necessary. Fig. 11 shows a corner of the riser with a hinge screwed on. Care and accuracy will be required in fitting on these hinges if they are to work well, but I will endeavour to give full directions. First at the front corner on each side where Fig. 8 is to go, glue on pieces of wood about $\frac{1}{16}$ inch thick, which will make the hinges project a little beyond the brood nest, and give the riser play. Let the glue set, and then put the riser on in its place, and to find the exact spot to screw Fig. 8 to, place its front edge fair with that of the riser and brood nest, and as low down as is consistent with the safe driving in of the screw in the lower of the two top holes. Mark for the screw holes and screw it on. Similarly for the other side. This hinge has to turn on the screw, Fig. 9; and to find the place for the screw, put the riser again in position, and bore with a bradawl well up against the edge of the hook of Fig. 8. Screw in Fig. 9 on both sides. Round off the front edge of the brood nest, and see if the whole works well. The use of the bracket in front is now clearly seen. Fig. 10 is a little plate to be let in over the screw, to keep Fig. 10 from shifting under constant strain. From these directions, it will be seen that the position of the upper screw holes must be exact. I have, therefore, given Fig. 8 life size. Now cover the joints of the two parts with pieces similar to those used for the joint with the floor board. The hinges must be let carefully into the two long sides of these strips, and the third screw hole utilized in its place, filing off the end of the screw if its shows outside.

Now for the roof: Fig. 1 shows clearly how it is finished with the ventilation holes. Fig. 4 gives a plan of one of its short sides with dimensions. The long sides are about 5¼ inches wide, and both short and long are of the ¾ inch stuff. The sheeting should be of the best *seasoned* wood; pine preferable. The eaves project about 2½ inches all round, and the eaves of the long sides and the flat board on top have a throat on their under sides. Cut the ventilation holes front and back, and cover them inside with perforated zinc before the sheeting goes on, and then nail it on carefully making white lead joints throughout. With similar hinges, hinge this to the *back* of the riser and cover the joint between the two as before. A light chain will help to keep each part of the top steady when open, but it should be easily unhooked if necessary. The porch can now be put on. Its position is easily seen from Fig. 1. The angle of slope is of no importance, and can be guessed at from the engraving. It is cut out of ¾ inch red, and nailed from the outside of the brackets; a rebate is first formed for it to sit in by tacking on two pieces above it as shown, Fig. 1.

As it is an important thing in summer to have a wide entrance for the bees passing in and out, and also to supply ample ventilation, I prefer to give the full width of the hive, and not only a small space in the centre as is left by most hive-makers. Doors are necessary, however, to contract or even close this space at the end of the honey season, when robber bees are very wide awake. To make these, cut a strip of pine, 17⅝ inches by 1 inch by ⅜ inch as Fig. 5. Cut this in half along A, B. Cut a second piece 17⅝ inch by 1¾ inch by ¾ inch, and run a rebate in it 1 inch by ⅜ inch as shown in section, Fig. 7. Nail this last piece on just sufficiently high to allow the doors to slide easily. A little piece will probably have to be taken from the bottom of the brackets to allow the doors to open out.

The whole outside should now get a good coat of white lead, painting also the under side of the brood nest where it touches the floor board, the upper edge and trough, the under and upper edges of the riser and the under edge of the roof. After the first coat is set, all the joints and nail holes should be puttied or white leaded, and the whole should get at least two coats more of any fancy permanent colour. I prefer to paint my roof white, and to paint anew every year, as it tends to keep the temperature inside more even.

In future papers, I hope to describe all, and more than all, the furniture necessary to work a first class apiary; but if you want to make money by bees, try and start as cheaply as possible, whereas, if you can afford to make a hobby of it, spend as much as you like, there certainly is a great charm in having quantities of really nice things.

(*To be continued.*)

HOW I FURNISHED MY SNUGGERY.

Being Part III. of "My Furniture, and How I Made It."

By MARK MALLETT.

I.—MY OCTAGONAL CENTRE-TABLE.

IN my unfurnished house, was a small room which I proposed to appropriate as my own sitting-room, during the remainder of my bachelor days, and eventually to retain as my especial sanctum and snuggery. Its size precluded its requiring any great amount of furniture, and in making the few articles needed, my leading idea was get as much convenience and comfort as possible. The room was to be one in which to read, write, and smoke, and in a general way to feel at ease.

Since without a centre-table, no room looks furnished, it was to such an article that I first turned my attention. I decided that I had only space for a table, the top of which should be 3 feet in width, and as in a small room corners are apt to get in the way, I resolved to make it octagonal, and in Fig. 1 will be seen an elevation of the table I devised.

In the plans drawn of this table, the appearance as well as the reality of firmness and solidity has been endeavoured to be given by showing the legs as made 1$\frac{1}{2}$ inch wood. In my own table, however, I used inch wood only for this purpose. As regarded actual strength, I found it sufficient, and any other worker who has not 1$\frac{1}{2}$ inch stuff to hand, may use it safely. But the legs so made *looked* a little weak when seen edgewise. This much it is but right to explain.

The legs in question, one of which is shown on the larger (2 inch) scale in Fig. 2, are 2 feet 2 inches long, and 5 inches wide at their greatest width. It will be observed, that by judicious sawing, a piece of plank 5 feet 6 inches long and 8 inches wide will cut the whole four. The manner in which these legs are bevelled off to give finish, is sufficiently shown in the diagram. The inner bottom corner (as at A, Fig. 2) is cut off to throw the weight farther from the centre, and consequently to enable the table to stand more firmly. The outer top corner (as at B) is cut away to receive one of those side-pieces on which the top rests. The dotted lines at C, show where the leg is clasped by the end of the bottom cross-bar. Those at D—supposing the leg to be the one seen in the centre in the elevation—indicate where the cross-brace is screwed along its top.

One of those bottom cross-pieces above mentioned is shown in plan on the 2-inch scale, in Fig. 3, whilst its edge is seen in Fig. 4. These cross-pieces are of 1 inch board, 3 inches wide, and 1 foot 7 inches long. The ends are cut so as to clasp the legs, and they are screwed to the latter with round-headed screws. Where the cross-pieces intersect at the centre, they are cut half through as shown, that each may receive the other; and they are fixed together with four round-headed screws driven from above. These pieces, when fixed, render the lower part of the table perfectly rigid.

The top ends of the legs are fastened together by a couple of braces of unequal length. In the plan of top (Fig. 5) which shows the lower side of the top and the arrangements of the legs, frame, etc., beneath it, these braces are marked E and F. They consist of two strips of $\frac{3}{4}$ inch wood 2 inches wide. The upper one (E, Fig. 5) is 2 feet 8 inches long. In Fig. 6, which is a section of the upper part of the table on line G, in Fig. 5, a sufficient portion of this brace is shown on the 2-inch scale. In this diagram, it is also marked E. At F, in the same figure will be seen where its lower edge is cut away to a depth of $\frac{1}{2}$ an inch to receive the lower brace which there crosses it at right angles; and at H is shown where it is cut away to the same depth to allow it to pass through an opening made for that purpose in the side-piece, as drawn at H, Fig. 7, also at H in the elevation, Fig. 1. The end of the brace projects 4 inches beyond the side-piece. This is to give additional support to the top where most needed. As this projection is not in the exact centre, it may be objected that it is unsightly. It is so in the elevation, but in the actual table it is so much below the eye as to be almost hidden by the overhanging table-top.

The lower brace is shorter than the upper by 9$\frac{1}{2}$ inches, being only 1 foot 10$\frac{1}{2}$ inches long, that is it merely reaches from one side-piece to the other. At the point of its intersection with the upper brace (which it will be observed in Fig. 5 is not exactly in the centre), its upper edge is cut away to admit that member to a depth of $\frac{1}{2}$ an inch. This brace, when fixed, will be 1 inch lower than the tops of the legs and the under face of the table-top.

As shown in the section, these braces are secured by simply screwing through them into the sides of the legs.

The frame which supports the table-top is formed of the four side-pieces marked I, I, I, I, in Fig. 5; the one of them seen in the elevation, Fig. 1, is also marked I. These are straightforward pieces of $\frac{3}{4}$ inch wood 2 feet long and 3 inches wide. One of them is drawn on the larger scale in Fig. 7. This is supposed to be the same piece as that shown in the elevation; and in that opposite to it, a corresponding opening to that at H, for the upper brace will have to be cut. The two remaining side-pieces will need no such openings. At their corners, these side-pieces are framed together, as shown, by a sort of rough dovetail-

ing, and fastened with screws (see K, Fig. 7). The four side-pieces rest at their centres in the openings cut for them in the tops of the legs (see B, Fig. 2), and each is screwed to its leg by two strong round headed screws.

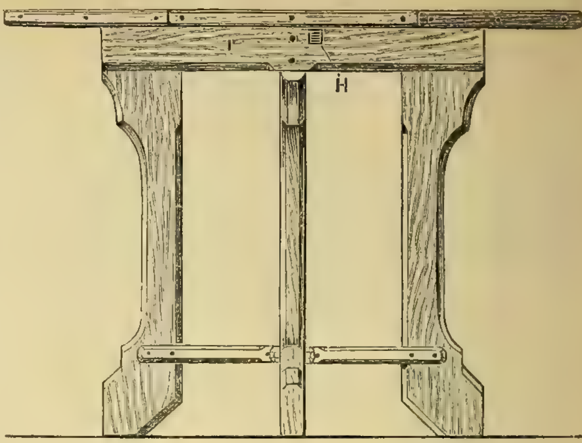


FIG. 1.—OCTAGONAL TABLE—ELEVATION.

In Fig. 6, the top is represented as made of the material used by myself—namely, $\frac{1}{2}$ inch matchboarding: $\frac{3}{4}$ inch stuff would doubtless make a better and more solid top, but this it is not easy to buy ready tongued and grooved. As a substitute for the tongue and groove, the pieces might, however, be dowelled together. I used four widths of ordinary 9-inch matchboard, and the widths when put together measure 1 foot 11 inches from side to side. These top-boards are, as shown in Fig. 5, to be laid at *right angles with the upper cross-piece*, and screwed down to it and the side-pieces.

FIG. 2.—LEG OF TABLE.

For covering the top of this table, I used a different material to that adopted for several of the articles previously described. Instead of American leather, I took a piece of ordinary cloth of a dark sage-green colour. I stretched it tightly over the top, and fastened it on the under side with tacks.

My choice of this fabric for a covering was made from æsthetic motives only. It was a whim in which others are by its means obliged to follow my example. I must admit that the practical advantages are almost entirely on the side of American leather-cloth, and it is probable that whenever I re-cover the top of my snuggery table I shall substitute a piece of that material of a dark green colour for the present covering. For a bachelor's room—a room never too daintily kept, and in which all manner of things are done—the leather-cloth is one of the best of table-coverings. It bears rough usage, and it is cleanly. Dust does not settle in it, and ink, as well as less objectionable fluids, may be wiped clean off it, and not a trace be left behind; which is not the case with ordinary cloth or baize. The chief objection to American leather, when used loose, is that in it the surface is apt to crack and peel off where it passes over edges, and especially at corners; but this by no means applies to it when it is fixed, and when the edges and corners are protected, as in this table.

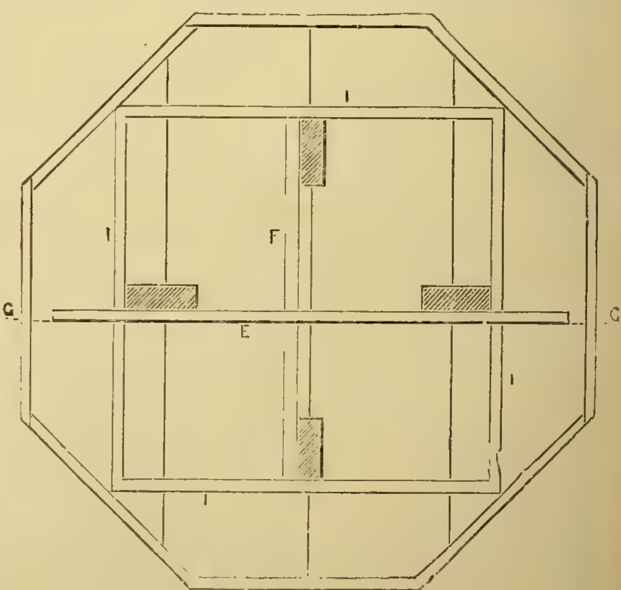


FIG. 5.—PLAN OF TABLE, SHOWING UNDERSIDE OF TOP.

I have used American leather-cloth for a variety of articles of furniture constructed on the same principles as those before us, and for many years. I can, therefore, speak to its value where properly employed, though I should scarcely recommend it as a covering for easy chairs. This, however, is a digression.

A finish was given to the edge of the table, and the tacking-on of the cloth hidden by the edge-strips, one of which appears in section and

is marked L, in Fig. 6. There are, of course, eight of these strips, which are of ½ inch wood, and 1 inch wide. As shown in Fig. 5, four of these strips are only 14 inches long, whilst the other four which overlap them, are 2 inches longer. As seen in the section (Fig. 6) these strips are neatly rounded off above and below, and if in fixing them the upper edge is kept slightly above the general surface of the table-top—say, $\frac{1}{16}$ of an inch—it will be found to have the advantage of preventing pencils, and such like matters from rolling off. Each strip is fixed in place by three round-headed inch screws driven into the edge of the table. The strips will thus have a further use in materially binding together and strengthening the top-boards.

FIG. 3.—CROSS-BAR IN PLAN.

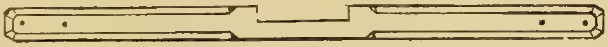


FIG. 4.—SIDE VIEW OF CROSS-BAR.

It will be seen that these strips can readily be removed whenever it may be found necessary to re-cover the table top. The superiority of screws over nails or glue is a point of which we never lose sight in this system of home-made furniture, and of this axiom we have here an illustration. In taking off these strips we can withdraw the screws without any danger of breaking, scratching, or otherwise injuring the work; and when the desired alteration has been made we can replace them with equal care and safety. And here it may be mentioned that whenever there is a probability that a screw may at any future time need to be withdrawn, it will be well before driving it the first time, to dip its point in oil. This prevents rust, and greatly facilitates its after removal, if required. For my own part I commonly practise this, even when I do not expect that the screw will ever need to be withdrawn, so much more easily and pleasantly does the oil make it drive. Two of the illustrations to this table, Figs. 1 and 5, are on the 1 inch scale; the remainder are drawn 2 inches to the foot.

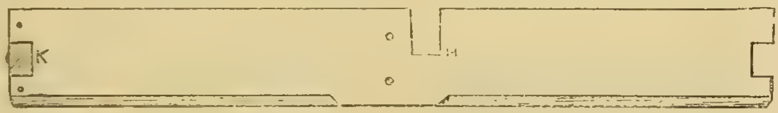


FIG. 7.—SIDE-PIECE OF TABLE.

FIG. 6.—SECTION OF TOP OF TABLE AT LINE G G IN FIG. 5.

When my little octagonal table was finished, I was, I must own, pleased with it. It was neat, quaint, handy, and did not monopolize too much of my limited space. The last point was, as before mentioned, an important one, for to make my snuggery cosy and complete according to my own views, I could scarcely do without some half-dozen other pieces of furniture, though most of those pieces might only be upon a small scale. A comfortable chair in which to lounge oneself, and a second in which to seat some favoured friend, are matters without which no bachelor's den would be worth the having; and the question of how best to construct such chairs was one on which my mind was exercised not a little. In amateur chair-making there are difficulties unthought of by those who have never attempted it. However, I trust that I shall by-and-by show that when I came to grapple practically with the business I was not altogether unsuccessful.

In my snuggery I should have to write, and a handy writing-table, at which I could have everything for my work conveniently about me, was essential. Such a table I accordingly planned. I am a reading man; I am fond of having books of my own, and more especially such books as are old and curious; and I have, moreover, a taste for collecting antiquities and curiosities of other kinds; and for these tastes accommodation would have to be provided in my sanctum. Then, in matters purely decorative, besides pictures for my walls, I had some favourite busts, which I wished to introduce, and for these my ingenuity would be taxed to provide pedestals, which should be in keeping with their surroundings. Last of all, I had indistinct visions of some sort of handy little table to stand beside my lounging chair to hold my smoking apparatus, or a book when I wished to lay it down, or what not.

My experiences in working out all these pieces of construction will be found in the ensuing articles: I trust they will be found useful and helpful to those who take to making furniture for themselves.

(*To be continued.*)

SMITHING AND FORGING.

By GEORGE EDWINSON.

X.—SUNDRY ODD JOBS IN SMITHING.

SUNDRY odd jobs will find their way to the smith in the shape of broken or worn tools to be repaired. From the garden will come broken forks, spades, and wheelbarrows ; or worn picks, hoes, and greenhouse accessories. From the farmyard we shall get broken and worn manure forks, broken chains, and parts of vehicles, bolts needing nuts, rusted nuts, demands for linch pins and other pins innumerable. From the woodman, a broken axe, or one needing repair, and iron wedges to be renewed. From road-men there will be worn picks, and bars, and hammers and other things needing repair. And, if mills and other machinery are employed, the name and nature of the repairs required to keep all in working order will be innumerable.

Making and Repairing Forks and Spades.—Garden forks are made of cast steel, and the prongs of these are liable to be broken by striking buried stones or large roots of trees. Sometimes their temper is good enough to bend, and the bent prong may be restored to its proper form and position by gentle treatment in a vice. Insert the bent prong lengthwise between the open jaws of the vice, then close these gently, and repeat the treatment at different parts of the prong until it has been brought into position. Unless badly bent this may be done cold. When badly bent, the prong may be heated to a dull red, restored to form, again heat the prong to a dull red, cool suddenly in water, and temper to a purple tint. When the prong is broken, a "ticklish job," as it is termed, presents itself to the amateur smith. In fact, there are professionals who do not care to take such a job in hand. The reason for this unwillingness rests in the known tenderness of cast steel in a smith's fire. Cast steel will be ruined if heated above a middling or cherry-red heat whilst in contact with a coal fire, and this is especially to be noticed when the coal is dirty. To weld cast steel we shall require a clean coal fire (coal entirely free from sulphur), a light hammer, and a special flux. We will first prepare the flux. First get about a quarter pound of borax crystals, easily and cheaply procured from an oil and colour store or a drysalter's, and heat it in an iron pot capable of holding one quart or more. The borax as bought will contain a quantity of water, and we must drive this off by means of heat, to calcine the borax salt. Whilst doing this it will puff up and toss itself considerably, so we must give it an abundance of room, else it will spue out into the fire. After being heated for a time, it will remain quiet, in the form of crusted white bubbles. These must be reduced to fine powder. Next get a piece of marble or of good limestone, and crush it as fine as possible. A good flux is made with three parts by weight of calcined borax well mixed with one part of finely powdered marble. Another good flux, recommended by Mr. Crane, consists of potash or pearl ash three parts, pure dried clay one part, well melted together in an iron pot, then add gradually to the fluid mass an equal weight of calcined borax. When this has cooled, it must be reduced to a fine powder. Also provide beforehand a small broom of dried birch or hazel twigs.

All being prepared, we will set about the job of welding together two pieces of cast steel. Place a heap of the flux on a piece of sheet iron on the hearth of the forge, and the broom beside the heap. Heat both parts to a dull red and scarf them ; heat up to the same tint, and roll the heated parts in the flux until well covered. Return to the fire, heat a little higher, take out, brush off the old flux, and roll again in the flux. Return to the fire, heat up to a bright red, and now be smart in the subsequent movements. Take out, brush off flux from scarfs, place them together, give them a gentle tap or two on the anvil with the hammer to stick them, roll in the flux again until well covered, return gently to the fire, heat up again to a welding heat, then gently brush off flux and finish welding. This being done the bar may be forged to proper size and form, then tempered, but it will be a little shorter than before.

It will not be out of place just here to state why steel must be subjected to a different treatment from that of iron. The main cause is a difference in the composition of the two materials. Iron is a pure elementary substance ; steel is a composition of iron and carbon, that is, an alloy of two substances. The same may be said with some truth of commercial iron, such as the material in general use by smiths, since absolutely pure iron has no commercial value in a smith's shop. The iron ordinarily wrought in the smithy contains only a small quantity, a mere trace, of carbon, just enough, in fact, to make it weldable and workable. Cast iron contains a larger quantity of carbon combined with other elements, such as silicon, manganese, and phosphorus. Steel contains a less percentage of carbon than cast iron, but the proportion of carbon varies with the quality of steel. On the other hand, the quality of steel does not always depend upon the proportion of carbon present in the alloy. Its quality is determined very largely by the processes it undergoes in making. But as a general rule the melting point, and also the welding quality of all grades of iron and steel is largely governed by the amount of carbon which they contain,

a large quantity of carbon rendering them more easily fusible. Now it is well known that carbon will readily burn in the presence of air, but will not so readily burn away if air is excluded. This is illustrated by the incandescent electric lamps, which are made up of a strip of carbon in a vacuum, or in other words, in a glass globe deprived of air. This strip of carbon can be kept to a glowing white heat whilst air is excluded, but the moment air is introduced the carbon flashes up and crumbles to ashes. If, then, we can heat steel in a case protected from air, its carbon will be preserved and the original composition of the alloy remain intact; but if heated to whiteness in the presence of air the carbon will burn away and leave the remainder of the alloy in a porous, unworkable condition. Steel thus treated is termed "burnt steel," and may be thrown on the scrap heap to be sold for old metal, for no subsequent treatment in the smithy will restore its lost carbon and valuable properties. As a guide to the safe heats for steel, I may say here, that mild steel and German steel may be heated to the welding heat of iron without injury; shear steel will endure a white heat in a glowing coal fire of good quality when not directly exposed to the blast; blister steel will bear a creamy yellow heat; but cast steel must never be heated above a cherry-red tint. These qualities of steel must be generally taken on trust from the vendors, since it is impossible to give here any reliable means for testing their quality. Such rough indications as the following may, however, be useful: Good cast steel will give a silvery tone when struck whilst suspended by a string. Other varieties will give a similar tone when hardened and free from flaws. Cast steel when heated to a dull red will resist the blows of the hammer more than milder steels, and these more than iron. Draw out the rod of steel to a tapering point, heat to a dull red, cool in water, then test by breaking off a small piece on the anvil with a small hammer. If it snaps off hard and short the steel is of hard quality; the toughest and mildest will resist this treatment, and bend before breaking.

The object, therefore, of covering steel with a flux whilst being heated, is to prevent the burning of its carbon; and this protection is afforded in the milder steels by a fusible flux of flinty or silicious sand; but this flux would not be sufficiently fusible for use with the more fusible and harder varieties of steel. Borax (bi-borate of soda) easily fuses at a low red heat, and then gives up its heat to the other materials with which it is in contact; hence its employment in the flux previously named, a flux which quickly encloses the heated steel in an air-proof case.

Having well understood the action and need of a flux, we will set about the job of mending the prong of the garden fork. Heat and scarf the broken ends, then file the broken ends fairly. Bind them together in position with iron binding wire, sprinkle a quantity of dried borax on the joint, and heat up in a clear fire until the borax fuses. Withdraw the joint at this point, and rub it in a heap of the flux until well covered; then return to the clear, glowing coal fire and bring to a welding heat. Take out quickly, place gently on the anvil, and give the joint a few light taps with a small hammer. Again rub in the flux, return to the fire, and repeat the heats, if necessary, until the weld has been completed. Success depends upon the use of a clear fire of bituminous coal, care in heating the steel to *its* welding heat, the proper use of the flux, and the force of the blows given to the joint. In all cases where steel has to be worked hot, the smith should aim at performing the work with a rapid succession of light blows; he cannot strike too fast, but his blows may spoil the work by being too heavy. The best temper for tools of this class is secured by hammering at a low red heat, then cooling in water, then heat up until a purple tint shows on the previously polished steel, and cool off in oil. Spades are not so liable to be broken; they are sometimes broken across the shank, but it is generally found to be less expense to buy a new spade than to mend an old one.

Picks and Crowbars.—"What is in a name?" Much, when the names of tools are discussed. The application of a special name to a general class of tools tends to destroy the distinctive value of that name. This has happened in the use of the distinctive name, "pickaxe." A special name given to a valuable tool combining the useful form of the axe, and the equally useful one of the pick, has been used in a general sense by most writers in describing the common pick employed by navvies, road-makers, and quarrymen. A glance at the illustrations—Figs. 213, 214, and 215, will show at once the difference between the different varieties of picks. Fig. 213 shows a common pick, made with a pointed bill at one end and a chisel bill at the other, both used in digging hard ground and in splitting rocks. Fig. 214 shows a pickaxe, a useful tool in making roads through woodlands, since the axe can be used in cutting tree roots and the pointed bill in breaking the ground. Fig. 215 shows a miner's pick, having a hammer at one end for driving nails, striking wedges, and boring tools, etc. All these tools may be made or repaired by the amateur smith. The eye or hole for the shaft is formed by first shaping the two sides as shown at Fig. 216, and then welding the two parts together, as shown at Fig. 217. The two ends are then forged down to their required dimensions, the ends split with a hot sett, as shown at Fig. 218, a wedge of

steel inserted in the cleft; then welded there, then drawn out to the required shape, and finally hardened and tempered to a brown tint tending to straw at the extreme point. The miner's pick has a solid hammer-head faced with steel, and the eye for the end of the haft is left massive, and of an oval form, tapering from both sides as in a hammer. A pickaxe should have a slice of shear steel enclosed between the folding leaves of iron at the axe end, and the two forged down together to form the axe. This should then be tempered to a purple at its junction with the iron, and from this tint to a straw at the edge. The general repairs to this class of tools consist in sharpening when worn blunt, and in laying when all the steel has been worn off. In this last case the end must be split, and a fresh wedge of steel welded in as in making a new tool.

Fig. 220 illustrates a bar of iron made into the form commonly known as a crowbar. It is an ordinary round bar of iron with steel-pointed ends. One of those ends is forged to a chisel shape, whilst the other end is first forged to a chisel shape, then split, whilst hot, to form a fork, and this is afterwards bent over to form a claw. In this form it is used by builders and fencers, the claw being employed to draw nails and bolts. The bars in use by quarrymen and miners are not furnished with claws, but have one of the chisel ends bent over to form a short lever used to prise open cracked rocks and stones. Boring bars and tools have their chisel-shaped points flattened out wider than the diameter of the bar, as shown at Fig. 221. These are made of best tool steel throughout. Crowbars may be made out of 1 inch, $1\frac{1}{4}$ inch, or $1\frac{1}{2}$ inch bar iron, and in lengths from 2 to 5 feet. When made of best tool steel (and many persons prefer this to iron) they may be made of lighter metal. A boring tool much used by quarrymen is made up of one 18 inch length of 1 inch round steel, and one 2 feet length of $1\frac{1}{4}$ inch round steel, welded to a length of $1\frac{1}{2}$ inch iron bar upset in the middle as shown at Fig. 226. This tool is from 5 to 6 feet in length, and is called a "jumper" by the quarrymen who make use of it in their work.

Crowbars and boring tools often wear blunt and have to be sharpened by the smith. This is done by heating and drawing out the cutting end of the bar to its original form, then hardening and tempering the edge. A purple is the best tempering tint for crowbars. Boring tools must be tempered to suit the rock being worked; but it is always safe to let the purple tint run down within half an inch or so of the cutting edge, let that be made ever so hard. In heating up all steel and steel-edged tools, do not make the steel more than red hot, and lightly hammer it well at this heat. Hammering at a red heat tends to toughen steel. If this rule and the above for tempering, is observed, the edges will not fly in working.

Axes and Hatchets.—These are made of iron and shear steel combined. A piece of flat iron of the desired width and thickness, and double the length of the required blade, is heated and bent over a tapering mandrel to the shape shown at Fig. 226. This mandrel should be of the same sectional size as the required handle. Next heat up and close the eye by welding the two leaves together at their junction near the eye. Then heat up the eye and forge to the required shape on the mandrel, finishing off by introducing the mandrel the reverse way, so as to slightly enlarge the inner edge of the eye. Next insert a thin slice of shear steel, the required width of the axe, between the two leaves of iron, heat both to a welding heat, and forge down together to the required thickness and width. By this means a layer of steel is enclosed between two layers of iron, and a steel edge is always ensured to the tool, because the iron is ground away, and the steel left when the edge of the tool is ground. Woodmen's axes are usually made to the form shown at Fig. 222, but other forms are adopted. They should never be made square-headed like a hatchet, because when made in this form they get injured by careless workmen, who use the reversed axe to drive wedges. Fig. 223 gives one form of a carpenter's hatchet. This is made in a similar manner to that of an axe, with this exception: a rectangular piece of steel is welded to the back part of the eye, and is forged down with it to form the hammer part of the tool. Fig. 224 shows a form in use by miners and fencers. The ear is made massive to withstand the shocks of hammering, because this tool is used equally as a hatchet and a hammer by men to whom such a combination tool is almost a necessity. A piece of bar steel forms the hammer, and a slit is cut in the blade for drawing nails. It is sometimes named the American hatchet, but a similar tool has been in use by Cornish miners for several generations. Axes and hatchets are finished in the following manner: The rough forging is reduced to shape by paring off superabundant material with setts whilst hot. The sides are then well hammered at a low red heat, and made as smooth as possible by this means. Then the tool is hardened and tempered, and finished off by grinding it on a grindstone, to sharpen the edge and polish the blade. These tools get out of repair by ill usage, the most general breakage being that of the eye, through using the tool as a sledge-hammer. In this case the fracture must be enlarged after being heated, the edges scarfed and welded, and the eye re-made.

Hammers.—Hand hammers may be made of cast, blister, or shear steel throughout, or they may be

made of iron faced with steel. To make a steel hammer it is only necessary to get a bar of steel the required size, heat, upset, and forge to the selected size and shape, punch the hole for the handle, then work it on a taper drift until the proper shape has been secured, tool off the hammer smoothly at a red heat, then heat and harden in water. To make a hammer of iron faced with steel, proceed in the following manner: Select a stout bar of iron, and, if it is not thick enough, make it up by upsetting. Make one end hot, and slit it with a sett to form a fork. hammer is to be of steel it will be advisable to weld in both ends of steel before cutting off the first. The "face" of the hammer is the broad, heavy part, the other end being named the "pane" of the hammer. Figs. 227 to 232 show a few diverse forms given to hammer panes. Fig. 227 shows the ordinary hand hammer, with ball pane used in engineering shops. The ball is used in riveting, to spread the end of the rivet. Fig. 228 shows the shape of a heavy hand hammer used by smiths. The pane may be used as a fuller, to spread a heated bar of iron laterally. Fig.

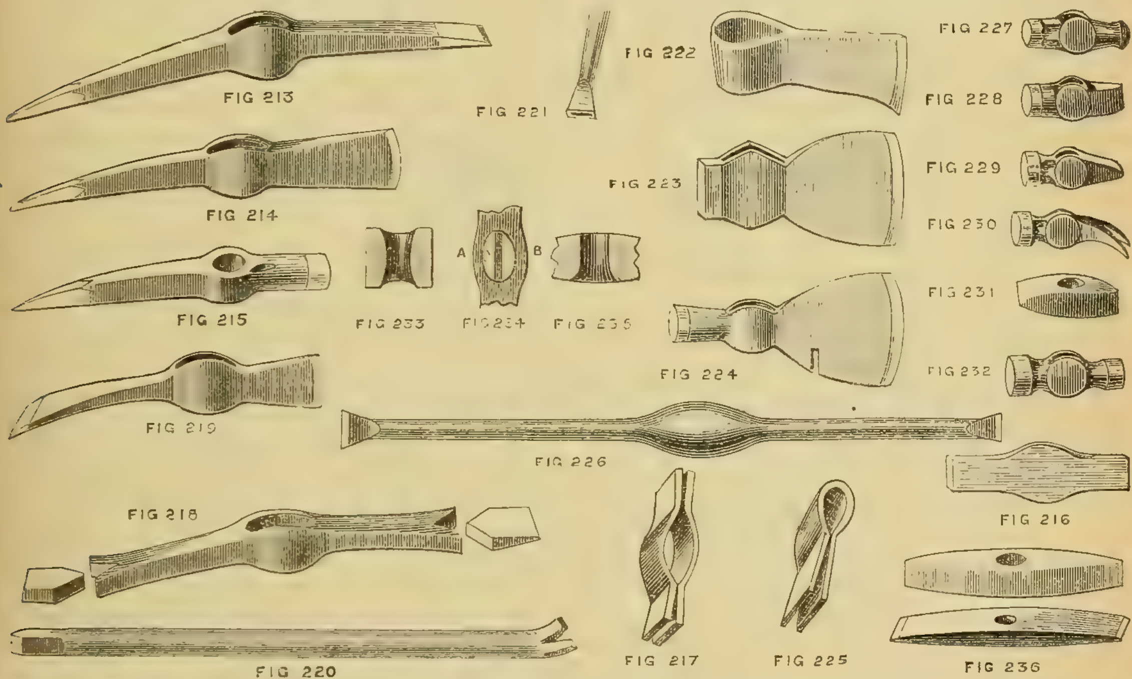


FIG. 213.—PICK. FIG. 214.—PICKAXE. FIG. 215.—MINER'S PICK. FIG. 216.—HALF OF EYE OF PICK. FIG. 217.—HALVES WELDED TO FORM EYE. FIG. 218.—PREPARATION OF PICK FOR STEELING. FIG. 219.—FIZGEY OR GRUBBER. FIG. 220.—CROWBAR. FIG. 221.—BIT OF BORING TOOL. FIG. 222.—WOODMAN'S AXE. FIG. 223.—CARPENTER'S HATCHET. FIG. 224.—MINER'S DAG OR HATCHET. FIG. 225.—FORMATION OF EYE OF AXE. FIG. 226.—QUARRYMAN'S JUMPER OR BORING TOOL. FIG. 227.—HAND HAMMER, BALL PANED. FIG. 228.—DITTO, FULLER PANED. FIG. 229.—DITTO, WEDGE PANED. FIG. 230.—CLAW HAMMER. FIG. 231.—CHIPPING HAMMER. FIG. 232.—DOUBLE-FACED HAMMER. FIG. 233.—SECTION ACROSS EYE OF HAMMER. FIG. 234.—TOP PART OF EYE. FIG. 235.—SECTION OF EYE, LENGTHWISE. FIG. 236.—MILL BILLS.

Take a bar of steel, and forge one end to form a wedge to fit in the above fork. Heat up the iron to a welding heat, and the steel to its welding heat (if necessary, in a separate fire), roll the steel in calcined borax, and weld the two together. Heat up again, this time protecting the steel with a welding mixture, or with sand, and finish the welding process. Next cut off the necessary length of steel, and forge up steel and iron to form the face of the hammer. Then fashion the head, punch the hole for the handle, form this on a taper drift, then cut off the hammer and finish to shape whilst held in a pair of crooked bit tongs. If both face and pane of the 229 shows a lighter hammer with a wedge-shaped pane. Fig. 230 shows a light claw hammer, such as that used by farriers in shoeing horses. Fig. 231 shows a form of chipping hammer with two wedge-shaped panes. This is used by boiler cleaners to chip the corrosion from boilers. Fig. 232 shows a form of heavy double-faced hand hammer, much used in heavy work. There are many other forms to suit various purposes in various trades, but I do not deem it necessary to illustrate all that is known to me, since a slight variation in form is all that distinguishes one from another. The usual weights are from one to two pounds. Enlarged varieties of Figs. 228 and 229,

weighing from three to thirty pounds, are named sledges. Single-handed sledges weigh from three to five pounds. Over this weight they are furnished with stout ash handles, from three to four feet in length, for use with two hands. In making hand hammers and sledges, particular attention should be given to the eye of the tool. The drift or mandrel on which this is formed should be taper and of oval section throughout. The peculiar shape of the eye demands the use of two oval section mandrels—one taper to form the lower side of the eye; and the other taper only on the longer sides of the oval, for the upper part of the eye. The necessity for this will be seen on reference to Figs. 233, 234, and 235. Fig. 233 shows a section of a hammer head across the head as from A to B, Fig. 234. The hole will be seen here to taper from both sides. On referring to Fig. 235 it will be seen that the hole tapers from the lower side only, the upper part being straight. This shows a section of the hole lengthwise of the head. The reason for this difference between the top and bottom of the eye in a longitudinal section of it is as follows: We taper the eye and round the edges nicely on the underside in order that the end of the hammer shaft or handle may be compressed whilst being driven into the eye, and to make it thus fit perfectly. The head is then not liable to be loosened in this direction, nor the shaft weakened at its junction with the metal head. When the head has been thus made to fit the end of the handle we cut off all superfluous wood, split the end with a chisel, and drive a wedge of well-seasoned wood into the slit, as shown at Fig. 234. This spreads the wood laterally and causes it to fill the upper taper across the head. If the eye is tapered in two directions it will be necessary to cross slit the end of the handle and drive in two wedges. This would weaken its hold on the head. If both handle and wedge are made of well seasoned wood there need be no apprehension of the head coming off even when subject to heavy blows.

Mill Bills.—These are steel chipping hammers used by millers to cut and dress millstones. They are made of cast steel, in the form of a double wedge (see Fig. 236), about 1½ inches square in the thickest part, and from 5 to 7 in length. The eye must be forged oval, as in a hammer. The bills must be forged at a low, red heat, heated to a cherry red, hardened by plunging into clean cold water, then tempered to a light straw tint on the cutting edge, graduating back to a purple about half or three-quarters of an inch from the cutting edge. These tools will often come to the smith to be sharpened, as they soon wear blunt. Millers highly esteem a smith who can temper the edges in such a manner as to make them extremely thin and hard, so as to cut well and stand without snapping. This is secured by care in heating and forging, and tempering in clean, cold water. In hardening steel tools, always plunge them edge straight downward in cold water, and swill them around with a circular motion until quite cold. Observe a similar care in cooling to temper the edges of tools.

(*To be continued.*)

PRACTICAL SCENE-PAINTING FOR AMATEURS.

By HENRY L. BENWELL.

XXI.—THE USE OF "CUT" CLOTHS.

ALTHOUGH not so frequently used as in "days gone by," cut cloths offer various advantages to the amateur scene-painter when wishing to produce a pretty exterior scene. In the first place, they can be utilised in place of the more expensive set of flats, and, secondly, as they roll up in the same way as an ordinary cloth, they take up no room, and are soon clear of the stage. It cannot be denied that when used in their proper place, they add greatly to the effect of a scene, especially when two or three cloths are used with all their apertures "gauzed," as in foliage or wood designs. The gauze which is invisible to the audience, produces a sort of atmospheric effect, and causes the back cloth to look natural, distant, and subdued in tone. The gauze can be had in all colours from Messrs. Burnett's, *King Street, Covent Garden;* the best colours to use being blue or grey, and as it is several feet in width requires no joining for a moderate sized scene.

Before going any further, it may, perhaps, be as well to explain the process of attaching the gauze to the cloths. This is the last process a cut cloth goes through before being hung, and as it must be done clean and quick, requires a good deal of knowledge and practice. Indeed, in theatres, it is work belonging to the carpenter or stage man, but the amateur or single-handed artist would, no doubt, have to take the task in hand himself. The scene is, of course, painted and finished before anything else is attempted. The next operation is to cut away all the canvas left white by the artist with a pair of scissors. If there is much foliage in the scene, it is a long and tedious job, and often takes up a whole day. As this work is usually performed by the artists' labourer, however, this is not at all surprising, as this gentleman never cares to overwork himself, not even at pantomime and other busy times. After all the necessary portions of the cloth are cut away, it is taken from the frame and care-

fully wound round a roller. It has just occurred to me that the method of taking a cloth from the painting frame has not, through an oversight, been yet explained; so I had better show at once how this may best be accomplished without cracking or creasing a new cloth. This is not so easily done as may be imagined, and many a good picture has been spoilt in even large theatres through the carelessness of the employes allowing the cloth to collapse and fall to the ground in one confused heap. It is, therefore, necessary to warn the novice to be most careful in taking a cloth off the frame, and always to give the operation his personal superintendence.

In large theatres cloths are not, as was once the case, wound round rollers, but are lifted by ropes and pulleys bodily into the "flies" next the gridiron. This being the case, a roller is kept in the paint room, on which a finished cloth is transferred. It is then taken from the paint room on to the stage, and then carefully unrolled on the floor where the carpenters quickly attach top and bottom battens and hoist it into its place. But in cases where a scene requires a roller (such as all amateur and fit-up scenery require) it is put on to the roller direct from the frame. In taking a cloth of either description off the frame, the whole of the tacks from the bottom and both sides are first withdrawn. The cloth is then rolled up on the roller, and if to remain on, the bottom is first tacked. The top row of tacks may then be removed, and the cloth lowered to the floor where the top batten is affixed, and pulleys and ropes adjusted.

A cut cloth is taken from the frame in exactly the same way and carried down to the stage, it is there unwound on the floor (which must be clean) *face downwards*. The next proceeding is to have ready a large pot of *hot and thin* glue, and having laid the gauze tightly over the cloth, carefully work the glue with a medium-sized brush round the edges of the perforated parts and larger openings; all the while seeing that the gauze is kept pressed to the canvas. When the edges are dry, work some thinner glue sparingly over the rest of the gauze when it will sink through the meshes and adhere firmly to the canvas. Allow the cloth to remain in this state over night, when all being dry it may be taken up, and will hang or roll up as well as if it had never been cut. The great thing to avoid in doing this work, is having the glue too thick, and laying too much on the canvas. Neither must it be too cold.

In Fig. 112 will be found a specimen of a cut wood. The design is as simple as it well can be, and the drawing has been so arranged as to give a pretty fair idea to the novice as to the way of arranging or hanging a cut cloth on the stage. The distant view at A is, of course, the back cloth, whilst the roller is seen resting on the floor, as the canvas being cut away, this is unfortunately seen in the opening at centre. It should, however, be painted a dark colour, when it is not so much noticed. The cut cloth is set away from the back cloth some three or four feet, and if the opening is not required, it is "gauzed" all over in the way just described. It is more than probable, however, indeed, it is generally the case, that these centre openings in cut cloths are required for entrances and exits, in which event the gauze is only glued over the smaller cut portions, and the canvas on the edge of the centre opening is stiffened with glue paste, and the foliage only cut round at the top, and tree trunks or large branches forming each side. In Fig. 112 wherever the distant country or sky is seen through the foliage of wood, it must be understood that the canvas is cut away, and the scene may be made to look still better, by perforating between the leaves in a more elaborate manner than shown in the sketch, and so showing glimpses of the azure blue sky more immediately overhead, and on each side of the canvas picture. I have more than once made use of four and even five of these gauze covered cut cloths with the greatest success, and they prove also extremely useful in weird and mysterious scenes, when the stage has to be darkened, and the ghost and other similar business introduced.

A totally different subject for a cloth of this description is given at Fig. 113. A stage carpenter would make this of three flats and a lot of profile, but it is almost needless to go to this expense on a "fit-up" stage when a cut cloth answers every purpose, and is a great deal more portable. In this design, the old doorway and ruined window frames are all cut away wherever it is left white. The window frames have the gauze at the back, but the doorway, if to be used, has merely the edge of the canvas stiffened as in the previous design. A suitable design for a back cloth to go with the last cut cloth, will perhaps be found in Fig. 53, Vol. V., p. 65. It requires a little alteration perhaps, and the ruins more elaborated, but with the aid of a few set-pieces, as shown in Figs. 115, 116 in the next chapter, it will prove to be just the thing for "Old Men and New Acres," and other plays.

The consideration of this method of stage decoration is of such great importance to the "fit-up" scene-painter, and the subjects are so various that may be treated in this way, that I feel compelled to give an extra illustration of a somewhat uncommon design, and one which the *amateur* would hardly think of treating in this way, whilst if it occurred to the professional mind, as it no doubt would, he would not consider a cloth good enough, but insist on the usual three or four flats. This is a mistake, for a cloth

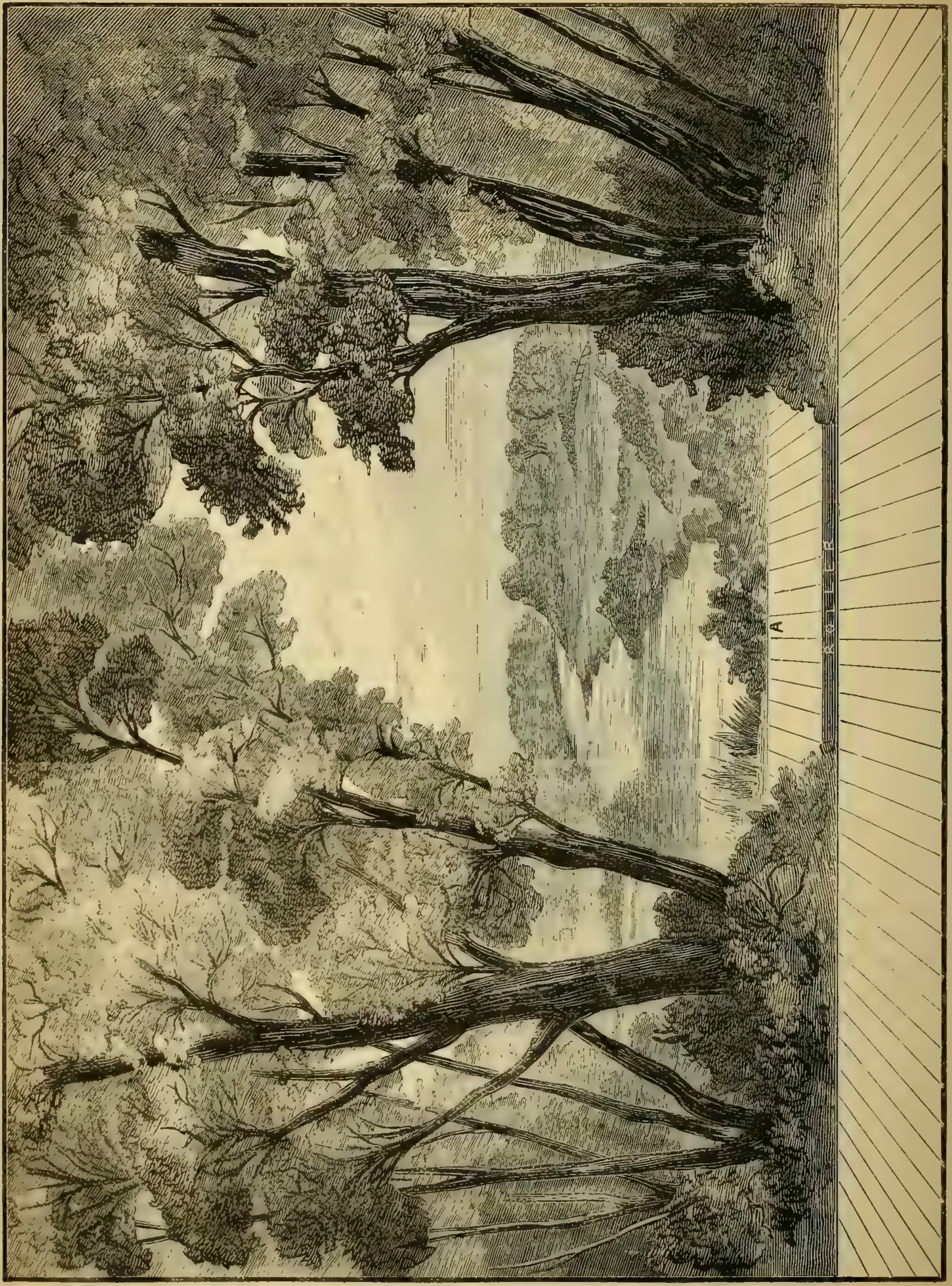


FIG. 112.—CUT WOOD, SHOWING ARRANGEMENT ON STAGE AND VIEW OF BACK CLOTH.

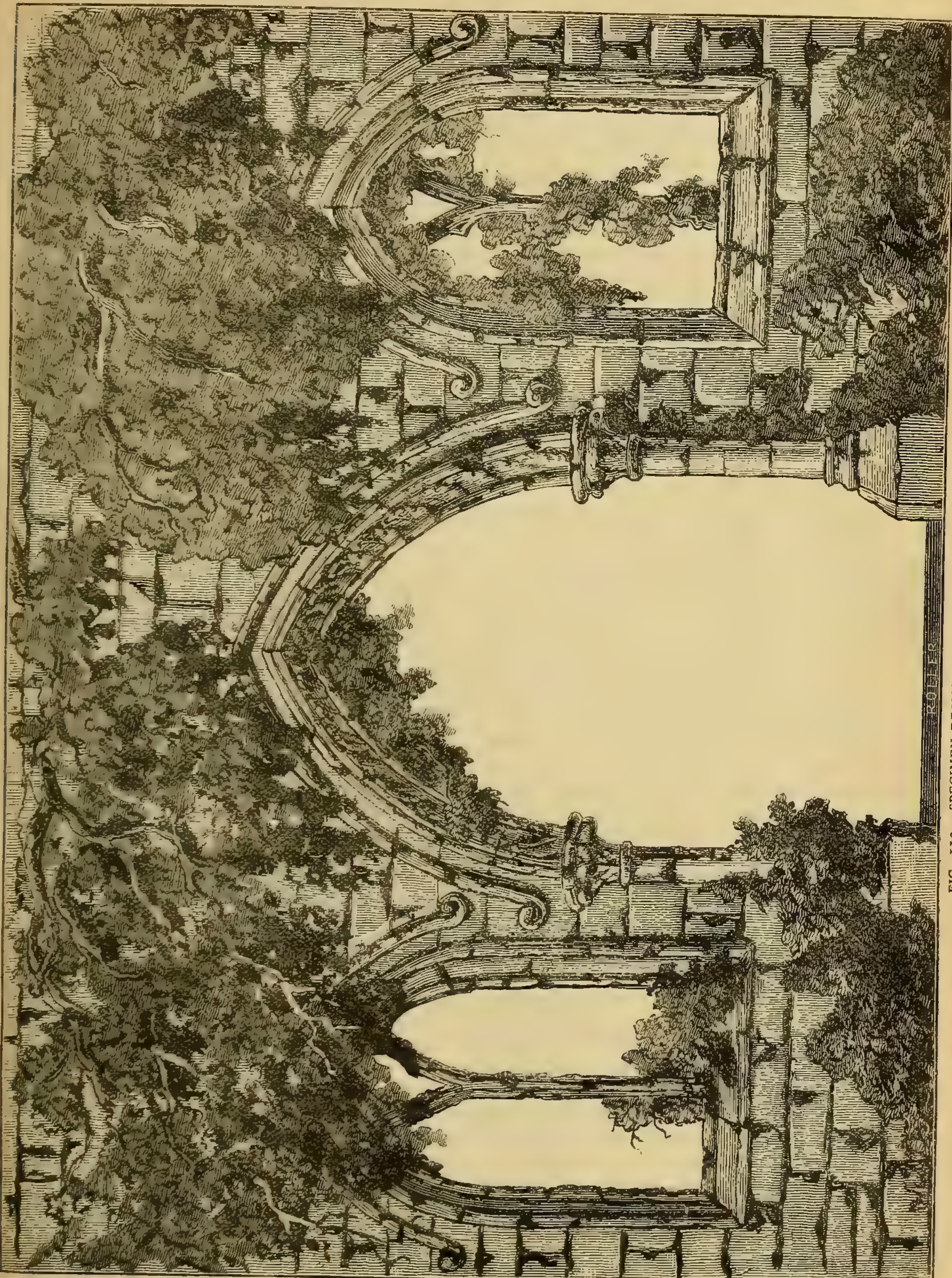


FIG. 113.—SPECIMEN DESIGN FOR A CUT CLOTH—ABBEY RUINS.

would answer every purpose for the subject given in Fig. 114 (see next chapter) which is suitable for several Shakspearean plays, such for instance, as the "Cup" or "Drinking" scene in *Othello*. There is one fault attached to cut cloths, and that is their swaying to and fro caused by a strong draught, or by the actors knocking against the canvas. The artist will do well to impress on the minds of the actors the undesirability of touching the canvas when going on and off through the openings. He should also take means to stop all draughts, as nothing looks more stupid or unnatural than massive stone walls or pillars constantly on the move. With foliage, this does not matter so much, but various dodges may be resorted to to prevent this defect, which will readily occur to an inventive mind.

(*To be continued.*)

UPHOLSTERY AT HOME.

By *DAVID B. ADAMSON.*

I.—TOOLS AND APPLIANCES USED IN UPHOLSTERY—MATERIALS—SUNDRIES—STUFFING.

WHEN I was asked to write a few articles on Upholstery for AMATEUR WORK, it was with some degree of hesitation that I consented to do so. I feel that an apology may be due to readers of this Magazine for shortcomings, and that they may regard them as well as the unavoidable delay in publication with leniency, I give my reasons for what might otherwise be construed into reluctance to impart technical information, or as it has been aptly termed in other words, "trade jealousy." It is perhaps hardly necessary to state that this motive has not influenced me; for even were I disposed to agree with those who wish to keep all knowledge on subjects with which they are presumably best acquainted, *i.e.*, their own trade, from the general public, I have derived so much advantage in the shape of practical instruction from papers in AMATEUR WORK, written by experts in other handicrafts, that I should deem myself ungrateful, were I to allow any such unworthy feeling to weigh with me. Apart from this, it appears to me that anyone who is afraid of explaining the method of his work can place very little reliance on his own skill, for after all it is not only or chiefly the knowledge how to do a thing, but the ability to do it that gives one the power to make a special branch of trade his own. This skill can only come by practice, and it is therefore absurd to suppose that amateur work can supersede trained technical work. When the two compete, then it must either be from the amateur worker having acquired the necessary dexterity, in which case all honour to him for his determination, or from the tradesman having sunk so low as to be merely an unskilled labourer.

At the same time, I can quite understand why some upholsterers—and I suppose some in other trades too—should be reluctant to have their "trade secrets," so called, made known, but with these I have no sympathy, as no calling can be elevated by having among its followers those whose chief aim appears to be the production of shams. These "secrets" I shall not explain further than may be necessary, in order to indicate what to avoid. I want to show how good honest work may be done, not to teach how the "counterfeit presentment" of it may be accomplished. This being so, I cannot fancy—as I have been told—that I do any injury to those whose work is above board. They need have no fear of loss by exposure, but rather the contrary, for the more the defects of "shoddy," and the merits of good work are understood, the better for them.

After this digression, I may say, without fear of misconception, that the chief reasons why I hesitated to write on upholstery were the difficulty of treating the subject properly, and the delay that would occur through my being able only to devote an occasional evening hour to writing on it as my time is much occupied. The former was the chief cause of my reluctance, as I did not see how I could write about upholstery in a satisfactory manner—that is to say, in such a way as to convey practical instruction, and unless this could be done, I felt that I should only be occupying space that might be better utilized. There is, however, so far as I am aware, nothing published on upholstery that could be useful to the amateur, and on the principle that half a loaf is better than no bread, I determined to try what I could do. There is certainly one treatise—possibly more, though I believe not—and there are occasional articles on upholstery in technical journals, but these, though instructive to men in the trade and admirable in their way, are not such as would be of much service to those who are quite unacquainted with the subject.

No pretence is made that the present articles are written for experts, and my object will be attained if I can make it clear to novices how they should start work, and finish a seat less appalling to an upholsterer's eye than the frightful contrivances which generally result from amateurs' attempts at stuffing and covering. I cannot promise to convey instruction so well as by ocular demonstration, for in upholstery, perhaps more than in some other crafts, written directions, even if accompanied by illustrations, I fear cannot clearly convey all that should be known, unless indeed the pen be in abler hands than mine, therefore if the learner can get some friendly practical upholsterer to show him how anything he is doubtful

about may be done, by all means, let him avail himself of the opportunity. Access to upholstery workrooms will only be obtained as a favour.

Although upholstery, as an amusement, is rarely practised, I see no reason other than the difficulty of knowing how to set about it, why amateur efforts should not be quite as satisfactory as in the allied occupation of cabinetmaking, and equally useful to the economically disposed. The work is light, and there is great scope for the display of taste in elaborate upholstery, the choice of covering materials, colours, etc., being almost endless.

I would not, however, advise the beginner to use any but cheap materials, till he has gained some proficiency, otherwise discouragement and waste will be the certain result, nor will it be well for a time to attempt anything big, such as an easy-chair or couch. Probably home upholstery will be chiefly confined to renovating and re-covering seats, and my endeavour will be to describe the work most likely to be useful and successful. Although at the risk of being tedious in description, I assume that the reader has no knowledge whatever of practical upholstery. If he should have, I think he will be the exception, and therefore he will no doubt pardon any seeming prolixity. With every desire not to omit details, some that are requisite to a beginner may be omitted, if so, let me say once for all, that any question which the Editor sees fit to insert in Amateurs in Council shall, as far as possible have my prompt attention. The tools required naturally claim the first consideration on starting a new branch of work.

Those for upholstery are both few and inexpensive, the only special appliances being as follows :—

1. *Hammer.*—This is much lighter in every way than the ordinary carpenter's hammer, being by comparison a very attenuated affair. A general size is about 13 inches long, with a head of 5 inches from end to end. The thin end is finished with a claw; the other is occasionally roughened to prevent slipping. Fig. 1 gives a good idea of this tool.

2. *Cabriole Hammer.*—This is similar, but with the broad face of the head very much smaller. The amateur need hardly provide himself with one of these as though a handy tool he will probably not find much occasion to use it.

3. *Web Pincers.*—The chief peculiarity of these is in the jaws, which are shown in Fig. 2. It will be noticed that the faces are corrugated or ribbed in order that a firm grip may be got on the web. The use of this and the other tools will be fully explained in describing work.

4. *Web-Strainer.*—There are several forms of this in use. Two of the most common are here described. Each has its own advocates, and doubtless its own merits, but they are both good, and whichever is preferred may be adopted. Briefly it may be said that the spike-strainer is considered by some to be quicker in action than the other, but that it has a tendency to tear the web. Properly used it does not, nor with those accustomed to the other is there much if any saving of time. The form known as the spike-strainer is to be bought, the other sometimes called from its shape the "bat"-strainer, is not, so far as I know, on sale in shops, but is made for or by the user. Both bat and spike-strainer can, however, easily be made, and I therefore describe them fully—measurements, etc., being taken from two before me that are in daily use in a leading shop. The spike-strainer consists of a piece of oak—any hard wood will do—7 inches long by 2 inches wide and $\frac{3}{4}$ inch thick. The centre is slightly hollowed on all four sides, and rounded to afford a comfortable hold for the hand, the ends are tapered off to $1\frac{5}{8}$ inch by $\frac{1}{2}$ inch. In one end are three round spikes, in the other two. The spikes are $\frac{5}{8}$ inch long, or rather they project that distance from the wood, and at the basis they are about or a little over $\frac{1}{8}$ inch thick. They might easily be made by driving screws in and afterwards filing them to a point, or by sufficiently thick pieces of iron fixed and pointed. A high degree of finish is not necessary. Figs. 3, 4, and 5 show the general shape of this tool, which costs about 9d. or 1s. if bought from a tool shop. Figs. 6 and 7 show the bat-strainer. It is 12 inches long by $3\frac{3}{4}$ inches wide by $\frac{3}{4}$ inch thick; one end is rounded and shaped to form a handle, the other is rebated across to the depth of $\frac{3}{4}$ inch, across the wide part, starting $1\frac{1}{4}$ inch back from the rebate is cut a hole measuring $2\frac{1}{2}$ inches long by $1\frac{1}{2}$ inch wide on top. In width it tapers down to $\frac{1}{2}$ inch at the bottom, both sides being equally bevelled. In length it is the same throughout. All that now has to be done to complete is to shape a piece of wood so that it will loosely fit the hole. To prevent this small piece being mislaid it is usually attached by a bit of string or strip of leather, or anything convenient a few inches long to the bat. In neither of these strainers is it necessary to adhere closely to the sizes, which are merely given to form a reliable guide to those who wish to make their own.

5. *Regulator.*—This is a piece of iron or steel, one end of which is flattened and rounded, the other tapered off to a point. It is made of various lengths; my own is 9 inches—and it is sold at per inch. Fig. 8 shows its shape.

6. *Needles.*—These will be considered later on as opportunity for using them occurs, when the best form and size for the work on hand will be named. They are made both curved and straight. A couple of each will be quite enough.

Other tools not being specially constructed require no comments, but for the sake of completeness they may be enumerated; they are, mallet or hammer, screwdriver or old chisel, compasses, scissors, which should be fairly large, straightedge and rule, a large square, knife, pincers, and bradawl. By the way there is a special form of this for upholsterers' use called a pritch or pretch-awl. I am not sure how it is spelled, as I do not remember to have seen the word printed, but I write it as pronounced. In some places it is not known, and I have come across old upholsterers who have never heard of it, so that its use is by no means general. A fine bradawl answers every purpose, and is generally used instead, a short one does very well, as it is only used to make holes for studs, which being tender, cannot generally be driven into the wood unless it is bored first. Other tools are occasionally wanted, and whenever this may be they will be mentioned. In large towns no difficulty will be experienced in buying the special tools on the spot, but in the smaller they are not usually to be obtained unless specially ordered. In London they are to be had at dozens of tool-shops, and reliable qualities may be got from both Melhuish and Lunt. I can safely recommend those they supply for quality and value. For foreign made hammers—French or Italian, I believe—Carpani and Son, 25, *Goodge Street*, *Tottenham Court Road*, *London*, have a good name among some upholsterers in London, but I do not know that there is any special virtue in their tools. It is to a great extent a matter of being in the habit of using a tool to which the hand becomes accustomed, and the amateur is hardly likely to be so constantly at work as to notice any trifling difference in weight or shape. This will be perhaps the fittest time to refer to the upholsterer's work-table or bench, though no amateur need go to the expense, trifling as it is, of providing himself with one. Any table, say a kitchen one, will serve just as well as the regular thing, which is nothing more than a few boards fastened together and laid on trestles of a convenient height.

The materials used in upholstery are very numerous, and it will be impossible to name more than a few of them. They may be roughly grouped into foundation, stuffing, covering, and trimming materials, and without pretending to give anything like a full list of them, a general notion of the principal will be of assistance in guiding the amateur. Possibly a few words on how and where to purchase these things will not be amiss. Naturally the amateur upholsterer will not care to procure more material of any sort than will suffice for the work in hand; for example, having, say, a couple of chairs to re-cover, he would not find it profitable to buy a whole length of covering, nor after stuffing a seat or two would he wish to have the odd hundred pounds out of a hundredweight of hair remaining "in stock." Now quantities are just what I can't give without knowing the size or seeing the chair which it is proposed to work on; and I can think of no better way to ascertain how much of each material will be wanted for a particular piece of work than for the amateur to go to some respectable upholsterer's and say what he wants to do, giving measurements and general shape of the chair. Any good upholsterer would then be able to tell very closely what is necessary, and would no doubt supply the materials. Of course, I don't mean to say that upholsterers would care to take the trouble to advise and work out quantities for all and sundry who chose to apply to them, but if the object were explained, and the upholsterer asked to supply what was necessary, I do not imagine any difficulty would be experienced. Good practical upholsterers—I don't allude to furnishing drapers, dealers or brokers—are to be found in almost every town in the kingdom; and, personally, I shall be very happy to assist amateur workers to the utmost of my power to get what they want, either through my firm, whose name and address the Editor will insert if he thinks fit, or by giving them names in their own districts, where I may know of reliable people to deal with. One thing, however, I will not undertake to do, and that is to give the names of wholesale houses who supply upholsterers with stuffings, coverings, etc., as it would neither be fair to the retailer nor advantageous to the purchaser of small lots such as an amateur would want. Few, if any, wholesale firms would care to be bothered with or supply these, or were they to do so the prices would probably not be lower than those charged for similar things by a retailer who knows his business. Apart from this the advantage of being able to get exact quantities with little or no waste should compensate for any trifling increase in cost. One thing I would recommend, and that is, for the purchaser not to go to a second-rate shop for what he wants under the mistaken notion that he will buy cheaper. He may by chance be able to get things at lower prices, though it is by no means certain that he will. If he does he may depend on it that the quality will be also lower. In bedding especially it is necessary that all stuffing materials should be of the purest. This fact can hardly be too strongly insisted on, some of the low-priced bedding supplied by unscrupulous dealers being unfit for a human being to lie on. I may have more to say on this point when treating of mattress and bedding making, which will be dealt with in due course.

Another branch of upholstery—viz., of curtains, hangings, and blinds, I do not contemplate including in the present series, unless in response to the wishes

of any considerable number of readers, when our Editor will no doubt be as pleased to satisfy them as I shall be to do my part. So now, gentlemen, speak up, and let me hear, through the Editor, what you want written on upholstery matters, as unless you tell him and me what your requirements are I may omit exactly the subjects most interesting to you.

I have already said that materials may be roughly classified according to their position when the work is finished, and it will be convenient to place them similarly in the following list, naming sundries first, then stuffing, and lastly coverings with trimmings.

Web.—This is a stout linen banding about two inches wide, made up in lengths of 18 yards, etc. It is used as the support of the stuffing in chairs, etc., and should be well stretched, otherwise the seat will drop in the centre. Those known as Nos. 10, 12, and 14 are generally used.

Scrim.—This is a coarse thin kind of canvas. The $\frac{4}{4}$ (*i.e.*, one yard), is the most useful for general purposes, though in some cases $\frac{3}{4}$ (or 27 inches) cuts to better advantage. Good makes of this are fairly up to the nominal widths.

Hessian Canvas.—This is like scrim, only coarser and closer. It is generally known simply as Hessian.

Wadding.—Both white and black is a preparation of raw cotton coated on one side with size or thin glue to form a backing. It is made up in bundles of 12 yards in a piece, and is sold by the yard. The width is about eighteen inches, but as it is split open before using the available width is about one yard.

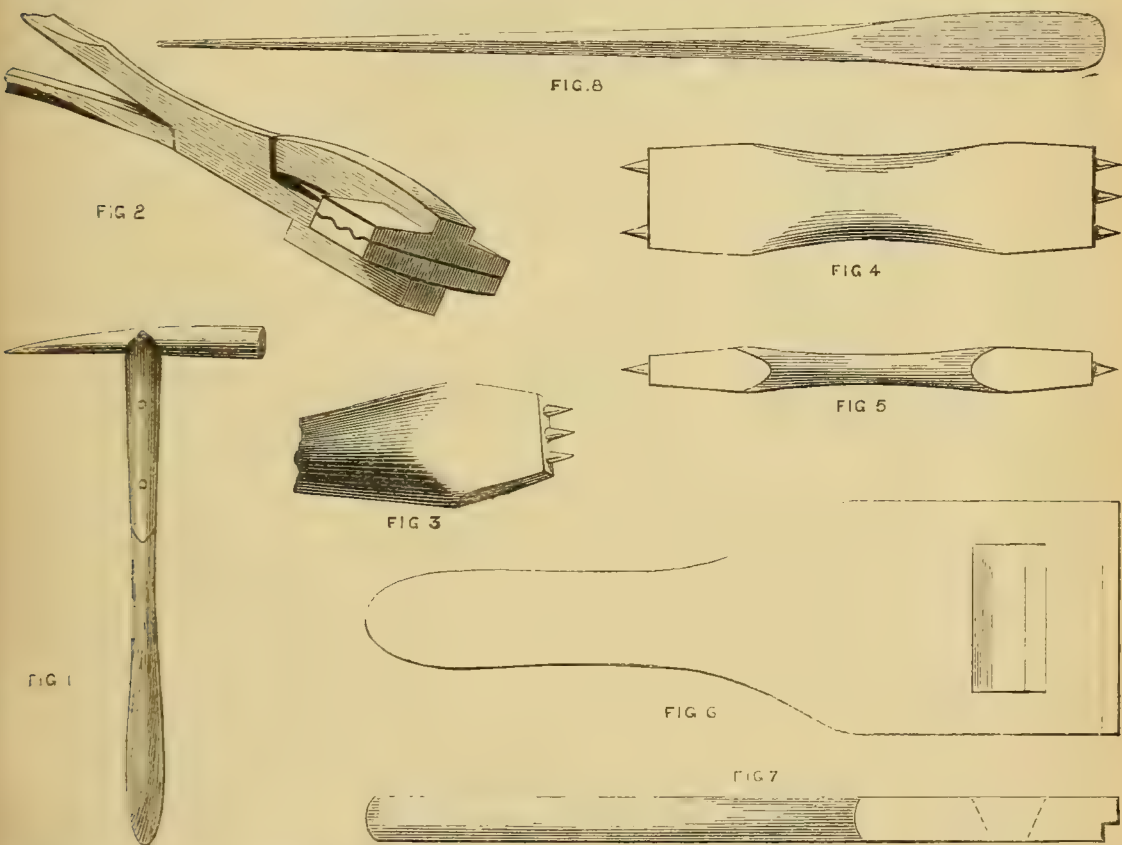


FIG. 1.—UPHOLSTERER'S HAMMER. FIG. 2.—WEB PINCERS. FIG. 3.—SPIKE STRAINER, PERSPECTIVE VIEW OF END WITH THREE SPIKES. FIG. 4.—DITTO, PLAN. FIG. 5.—DITTO, SIDE VIEW. FIG. 6.—BAT STRAINER, PLAN. FIG. 7.—DITTO, SIDE VIEW. FIG. 8.—REGULATOR.

Holland.—Black, white or bleached, grey or unbleached, are all used, though the latter two are chiefly employed for loose covers.

Calico.—Grey and white.

Twine.—For upholstery purposes, is required in three sorts. A fine thin make for stitching; one rather thicker, glazed whipcord, for buttoning; and a coarse strong make, packing or laid cord for fastening springs in heavy work.

Tacks.—$\frac{3}{8}$ inch, $\frac{1}{2}$ inch, and $\frac{5}{8}$ inch of the sort known as cut tacks are the sizes principally used, though for very fine small work $\frac{1}{4}$ inch are sometimes better. They are sold per thousand.

Gimp Pins.—These are small fine nails or pins japanned various colours to match different gimps, but black is the usual finish. The general sizes are $\frac{3}{8}$ inch and $\frac{1}{2}$ inch, sold by weight.

Springs are made from 3 inches to 12 inches, the measure being in height when the springs are free, that is to say, when they are not compressed; 5 inches to 8 inches are the sizes mostly required except for large work, spring mattresses, etc. For these 9 inches and 10 inches are better for general use. Springs are made from wire of various gauges, those for backs and soft seats being weaker, as a rule. All springs should be coppered to prevent rust, which soon causes rot and consequent disruption in a chair seat. The sort having what are known as "coiled ends" are to be preferred to those with tied ends. In the former the ends are fixed by a bend of the end, while in the latter they are bound with thin wire.

Curled Hair is undoubtedly the best material for stuffing, though unfortunately there is a good deal of rubbish sold as such, but principally composed of various fibres and very inferior hair. Old hair is also occasionally recarded and sold as new, though it is needless to say no respectable upholsterer would do so. Let me caution all amateurs to beware of buying or using hair from old mattresses, or, indeed, any stuffing from such sources, unless they know where and how the bedding has been used, otherwise they run serious risk in the event of its having been slept on by people suffering from contagious diseases. Apart from this consideration, there would be little advantage in buying old hair, unless the purchaser were possessed of considerable knowledge of the article. In cleaning and recarding old hair, great loss frequently results from waste, and it will be found more satisfactory in the long run to use only good new hair. When buying hair it should be ordered loose, *i.e.*, carded, not in the rope.

Cotton and Woollen Flocks should only be used especially in bedding when of first rate quality.

Alva, or Alva Marina, is a sea-weed. It forms a healthy and cheap stuffing, which may be safely recommended for mattress filling. Much of that which comes to this country is however too soft and limp to be worth using. Though not invariably so, the French alva is generally the best. Like all vegetable fibres, it does not retain its elasticity so well as hair.

Crin Vegetal, or Algerian Fibre, as it is sometimes called, though it comes from other countries besides Algeria, is another economical filling prepared from palm leaves.

Cocoa Fibre is similar, prepared from the outer husks of the nut. It forms an excellent cheap mattress, and is much used on account of its good qualities and low price, for hospital and charitable institution bedding.

Hay was at one time more used in chair seats than now, but in a future article I shall have occasion to refer to this more particularly.

Feathers are used principally as a filling for beds, bolsters, and pillows. To render them fit for such purposes they should be thoroughly cleaned and purified. Without proper appliances of a complicated and costly description this cannot be done, though washing only will get rid of a good deal of dirt. While undergoing purification their manipulation requires considerable technical knowledge and experience, so that I cannot advise any amateur to attempt this. If he has any raw feathers which he wishes to use, he had better send them to a bedding manufacturer who has the requisite plant at command, to be cleaned, for however clean they may seem, raw feathers *always* require to be dressed. The old-fashioned notion, still prevalent in rural districts, that feathers may be made fit for bedding purposes by putting them up loosely in bags, and giving them an occasional beating, is an erroneous one, and I can only attribute the idea that feather beds are not so healthy as mattresses to the fact that the feathers are often not properly purified; by properly purified, I mean not simply the removal of dirt, but the elimination of decaying matter from the quills or stalks. Both "poultry" and "goose" feathers are used for bedding, the latter from their superior qualities being preferred where price is not the first consideration. White feathers command higher prices than grey, and though they look better, it is doubtful whether they are more serviceable. Opinions differ on this point, but it may be safely asserted that the best grey feathers are better than poor whites.

Down.—This is principally employed for the filling of the down quilts, which are deservedly becoming increasingly popular on account of their combined warmth and lightness. Although popularly called, and supposed to be Eider down, very little of this is really used, and it is seldom seen. Whatever name it is known by, that in general use being goose down. In the lowest priced quilts, the filling can only be called down by courtesy, feathers, owing to their comparatively small value, being freely mixed. Even in the lowest quality of these quilts there is though, generally, some down, but if they were called feather quilts, the designation would more accurately describe some of them.

Here, I think, is a good beginning, and a good beginning, as you know, paves the way for a good ending.

(*To be continued.*)

REPOUSSE, OR RAISED METAL WORK.

By H. C. STANDAGE,
Author of the "Artists' Manual of Pigments," etc., etc.

IV.—Requisite Tools—Meaning of Term "Repoussé"—Articles Suitable for the Work—Action of Tools in Metals—Hammers and Punches.

IN our previous articles, we have gone into the history of this fascinating art; we now purpose to detail how the work may be carried out. Repoussé work is not so generally known and practised as to become common; consequently, there are only a few places where the requisite tools can be obtained. One maker was mentioned in this Journal in March, 1866, and another advertises his wares in the "Bazaar." A sum of half a sovereign should be enough to purchase a complete outfit of tools—a hammer, punches of various kinds and sizes, and sheet metal, usually brass.

At first sight, "only a hammer and punches!" The ultra-æsthetical reader will think the work is coarse and vulgar. Not so, however! It is less easy then china painting, and it is artistically more valuable, for an accurate knowledge of the nature and qualities of the metal worked upon are requisite before anything above crude work can be produced. The art does not consist solely of punching up one surface and hammering down another, the thickness, malleability, and other qualities of the metal operated on have to be considered, and the problems presented for solution are as difficult as those involved in painting a first-rate work of art.

The French term *repoussé* literally means "pushed up," a word which very well describes the operation. The metal, in sheet ready for working. is laid face downwards on some more or less yielding substance, and the pattern sketched or scratched out on the back—roughly, if simple, carefully, if complex. The worker then proceeds to beat down with punches and a hammer those portions of the design which are to appear in relief on the right and under side. When he considers that he has obtained a sufficiency of relief the work is turned right side uppermost, and is then chased over—that is to say, the workman goes over the sheet of metal with a sharp ended punch and a hammer, rendering the edges of the relief sharp and well defined, and putting in all lines and hatches which could not well or easily be beaten in from the body, such in brief is a general outline of the process. "The ancient artists and artizans and plumbers operated in this manner in gold, silver, bronze, brass, iron, steel and lead—in fact, the whole range of metals with which they were acquainted, and always with marked success. Of course, the operation is easy enough with ductile metals, such as gold, silver, and lead, and even with those rather refractory, such as bronze or brass, but when we see good specimens of repoussé work in iron or steel, such as those produced by the Italian armourers of the fifteenth century, they awake our astonishment and excite our wonder, the intractable metal appears to have surrendered itself to their tools with the ductility and docility of a mass of putty. Pre-eminent amongst these men of genius may be reckoned Benvenuto Cellini, the Florentine goldsmith, a ruffian and a reprobate, but a workman of an unrivalled skill and dexterity. Such work of his as has come down to the present day—morions and cuirasses, dagger and sword hilts and sheaths—are of unequalled delicacy and beauty."

A visit to the South Kensington Museum, will repay one who intends to "go in" for this art. In the two recent Exhibitions, Gardner and Starkey, in the Old London, had a workman executing repoussé work, chiefly in iron and steel, two of the hardest and most difficult metals to work at in this method, yet the work that left that man's hands was really beautiful; of course, nothing so fine in execution could be obtained as in gold or silver, but the work was undeniably artistic. And here is a field open to those who want to earn pocket-money at home.

China painting is over-done, hand-painted cards and photographs stock the market, crewel-worked antimacassars sell only at a bazaar, and many ladies of limited means are anxiously looking around for some means to eke out their slender income, while yet there is in repoussé work a field untouched. The fancy work above mentioned is very pretty, and good of its kind, no doubt, but then it is only ornamental and very seldom useful; but in repoussé work we have both utility and beauty combined. But some reader exclaims a repoussé-worked sword hilt, or a medallion, is just as ornamental and much less useful than a painted flower-pot or card-tray. In these days of artistic refinement, when the wealthy desire to surround themselves with works produced by hand only, there are many openings in which beaten metal work can be made a useful adjunct to the decoration. For instance, brass door finger-plates, instead of the cast abominations so prevalent may be done in repoussé, when heraldic emblems, crest, monograms, or coat of arms may be worked in it.

Strips of brass worked in repoussé will well replace such abominable subjects at the sides of stoves as Cupid chasing a butterfly, on badly painted tiles. Plain tiles, or tiles with a conventionalized pattern, are admissible enough in such situations, but some such figure as we have indicated is in the worst taste.

Wall brackets for gas branches, or candle-lights, can be made in repoussé, and many other articles

that the amateur's taste will suggest to him. Not only in these articles is there likely to be a demand for beaten metal work when well done, but also in many ornamental knicknacks, such, for instance, as trays for holding visitors' cards, frames for photographs, medallion portraits of friends, or even a suite of buttons for the latest fashionable jacket or dress bodices. If worked in the precious metal, such as silver, such articles would form excellent presents, and be much more likely to sell at bazaars than hand-painted photographs.

Before directing how to use the tools, it is essential that the principles underlying the process should be comprehended by the tyro, and also the ductile qualities of the metals on which he works.

With the exception of iron, sheet metals are first cast into their slabs or plates and then laminated (this is a term applied to parts that consist of thin layers or laminæ [leaves] lying closely upon each other) into *thin sheets* between cylindrical rollers. In the manufacture of sheets of malleable (*i.e.*, malleability, from *malleus* a hammer, is a term signifying the capability of certain metals to be beaten into form without cracking) iron, steel and copper, they are rolled in the red-hot state, but most others of the metals and alloys are rolled whilst cold. This rolling of metals into sheets has greater advantages than beating the metal into this form by means of the hammer, as when it has been rolled, the hardness tenacity, elasticity and ductility of the metal, or alloy is increased to its utmost because the action of lamination (making into thin sheets) has been performed in a more uniform and gradual manner than when beaten out. The above quality of the metal is easily tested by taking a piece of sheet copper, and observing how easily it bends and is workable, compared with a similar piece of the same metal that has been subjected to blows with a hammer; the hammered copper cracks, splits, and breaks whereas the unhammered sheet bends easily without doing so. Now elasticity, ductility, and tenacity, are qualities which the repoussé worker has to thoroughly master. He must make himself perfectly familiar with the vagaries, so to speak, of each kind of metal; for instance, a higher relief can be hammered out of a sheet of copper than out of one of steel, this is so, because the ductility of the copper allows it to be easily worked whilst the tenacity of it still keeps the particles coherent, whereas, in the steel the relieved portion would be cut away from the other, if very high relief were attempted—excepting, of course, that the workman periodically tempers the steel to the operation in hand. The true secret of the great success of the metal workers of the fifteenth century is their intimate knowledge of the ductility, etc., of the metal they worked. They know that blows of the hammer given in a certain way would cause the metal to thicken, and other different blows to cause it to become thin, consequently, they adapted their blows and the position of the punch according to whether they wanted more or less metal in a certain part. If, for instance, in the hammering out of a human face, looking at it full face, they did not drive away the metal from the cheeks towards where the nose had to be raised, they would not have enough metal to stamp forward the nose to its legitimate length, but they would drive the punch through the metal instead; at present, these remarks are somewhat premature: they will be understood when the reader has further pursued this article. However, the following observations of the celebrated Dr. Dalton will set the reader thinking on this point.

Take a hammer, and strike a piece of sheet metal—say copper. You have not only hit it, but you have done something more—you have made the metal thinner where the hammer struck it than the original thickness; and if it be examined with a big magnifying glass, it will be seen that the periphery of the indent is raised in a ridge-like form somewhat above the surface of the thick metal, and also higher than the indent, and also than the original thickness. Now to the thinking mind it must be clear that some motion has taken place amongst the particles of metals on which the hammer fell. In fact, motion of a certain and definite kind has occurred, and this is how Dalton defines this action, "None of these preparations (*i.e.*, rolling, hammering, etc.) of the metal can go on without a material internal change in their substances. Notwithstanding the hardness of solid bodies or the difficulty of moving particles one amongst the other, there are several that admit of such motions without fracture by the application of proper force, especially if assisted by heat; the ductility and malleability of the metals need only be mentioned. It should seem the particles glide along each other's surface somewhat like a piece of polished iron at the end of a magnet, without being at all weakened in their cohesion.

"This gliding amongst the particles of metals is exemplified by the action of thinning them by blows of the hammer, likewise by the actions of laminating rollers and the drawbench, in which cases the external layers of the metals are retarded or kept back as it were in a wave, whilst the central stream or substance continues its course at a somewhat quicker rate. The necessity for annealing occurs when the compression and sliding have arrived at the limit of cohesion, beyond this the parts tear asunder and produce such of the internal cracks and seams met with in sheet metal and wire as are not due to original

flaws, and air bubbles which have become proportionately elongated in the course of the manufacture of these materials."

The reader should get a clear conception of this physical action of the particles of a sheet of metal. A clear conception is often gained by a homely illustration, therefore we offer the following: Roll out a piece of dough—such as used for cakes—to a thickness of half an inch, place it in the oven just long enough for each outside to form a slight crust, while the middle of it remains in the doughy condition; if, now, this dough cake be placed on the pasteboard and the roller passed along it, it will be seen that the dough is pressed out from between the external crusts, and the cake becomes larger in area but thinner. A somewhat similar action occurs amongst the particles of a piece of sheet metal when rolled or hammered, and in repoussé work one principle of the art consists in knowing where and how to strike the metal so as to drive the particles away from a certain place, or else gathered up in another certain place. Not that the particles on the external surfaces are brought nearer to each other by the compression caused by the blow, but that the intermediate particles of metal are squeezed away from between them, and the direction they take depends on the kind of blow given, or position of the punch head.

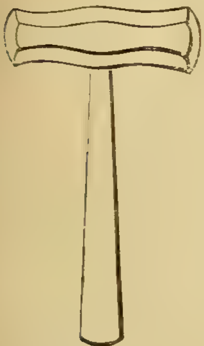


FIG. 6.—HAMMER FOR SOLID BLOWS.

FIG. 8.—HAMMER FOR STRIKING PUNCHES.

A sliding or gliding of a very similar nature occurs also in every case in which the metals are bent, and this differs only in degree, whether we consider it in reference to a massive beam, a permanent flexible spring, a piece of thin sheet metal, or a film of gold leaf. It should be remembered that the metals possessed of the malleable property undergo a nearly equal change in their arrangement, but the unmalleable or brittle metals break. Any visitors to the Inventions Exhibition in 1885, who watched the workman making brass and copper statuettes in "Old London," will readily grant that great skill is required to produce from a sheet of metal, a cup-like, hemispherical, or such-like curved form. The assumption of these forms are produced by the hammer alone—the process is called raising, by stretching some parts of the metal and contracting others.

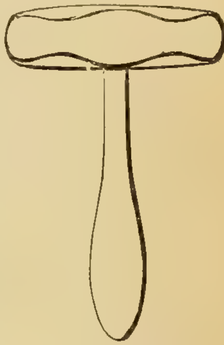


FIG. 7.—HAMMER FOR BENDING EDGES.

"When thin metal is struck between tools both of which are of metal, it is invariably more or less thinned; and should the blows be given partially, such parts will become stretched or cockled, and will distort the general figure. It is, therefore, usual, whenever admissible, to employ wooden hammers, and also wooden blocks or anvils when metal hammers are used, reserving the employment of tools both of metal either for the concluding steps, or for those cases where from the substance of the metal and the nature of the work, the wooden hammer would be ineffective, or a greater definition of form is required than wooden tools can give."

Any reader who has seen the potter working at his wheel, will have noticed how easily a formless lump of clay is made to assume some exquisite curved shape. It is fascinating to watch the process. A lump of clay is thrown on the potter's horizontal table. A touch of the fingers shapes it into a solid round lump, the potter thrusts his clenched hand into the centre, and it rises in form something like a basin; by applying the other hand outside to prevent the material spreading, it will rise as an irregular cylinder, and a gentle pressure from without and a sustaining pressure from within, will gather up or contract the clay into a narrow mouth suited to a bottle, and which is made somewhat in this manner almost by the fingers alone.

FIG 9

FIG 10

FIG 11

FIG 12

FIG 13

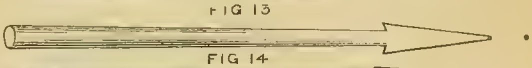


FIG 14

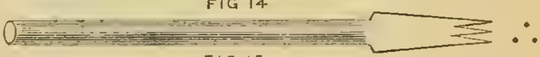


FIG 15

FIG. 9.—TRACER. FIG. 10.—UNIT. FIG. 11.—HALF-ROUND. FIG. 12.—"RING" TOOL. FIG. 13.—SHARP PUNCH. FIG. 14.—PICKER. FIG. 15.—PRICKER.

In this manipulation the particles of clay glide over each other in the manner already mentioned, and this is precisely the effect we have to produce in raising the metals by the hammer: in the former case it is accomplished by a gradual pressure of the fingers or hand against the clay; in the latter case, the hammer has to be used in only one particular spot at a time, and the raising of the metal accomplished by a series of circles of blows, applied much in the same order, and as far as possible with the same regularity of effect. The art consists, therefore, of two principal points: first, so to proportion the original size and thickness of the metal disc or plate, that it shall exactly suffice for the production of the required object, neither with excess of metal, which would have to be cut off with the shears and thrown aside, wasting a part both of the metal and labour, nor with deficiency of metal which would be nearly a total loss; secondly, that the work shall be produced with the *smallest possible number of blows*, which sometimes tend to thin, and at other times to thicken the metal, whereas the finished work should present an uniform thickness throughout, and which is, in many cases, just that of the original metal when in the sheet. For instance, a hollow ball 6 inches in diameter, is made of two circular pieces of copper, each 7½ inches in diameter; now, calling the original circumference of the disc 22½ inches, this line eventually became contracted to 18 inches, or the circumference of the ball, although at the same time the original diameter of the disc, namely, alone, if 7½ inches has become stretched to that of 9 inches, or the girth of the hemisphere.

In my next paper I shall proceed to working details, and describe the effects of hollow and solid blows—blows that will break, blows that will bend, and blows that will stretch or thicken a metal, illustrating the effects of each.

The following are illustrations of the various hammers and punches required. The latter can be added to *ad infinitum*, but only when the proper use of these punches is thoroughly acquired.

Fig. 1 is a hammer used chiefly for solid blows, or for bending a sheet of metal in its centre to form a cup-like depression. Fig. 2 is a hammer chiefly used for bending the edges of sheet metal; while Fig. 3 is the hammer used for striking the punches. When we get further advanced in the subject, we will describe the effects the different shaped handles and heads have on the blow. Fig. 4 is the "tracer" which is used for outlining the work; this is flat across the end. Fig. 5 is one with a curved or crescent-shaped end. Fig. 6 is the half-round or semicircular tool; and Fig. 7 is the "ring" tool, being a complete circle. Fig. 8 is a sharp point used for chasing the front of the work; while Fig. 9 is a "picker," useful for the matting of backgrounds; and Fig. 10 is a three dot pricker, useful for the same purpose, but making a triple indentation at a single blow.

(*To be continued.*)

METALLOCHROMY.

By CHAS. A. PARKER.

IN this short paper I will endeavour to furnish the requisite instructions for the production of the beautiful electro-chemical designs known as metallochromes or "Nobili's rings."

The method of producing this remarkable phenomenon, which was discovered by Nobili in the year 1826, may be briefly described as follows:—A shallow dish is first filled with a solution of sugar of lead, and a polished steel plate is placed at the bottom of it, and connected by means of a wire to the copper element of a three-cell Daniell battery. The wire from the zinc element being attached to a disc of copper that is placed over the steel plate, but not sufficiently close to come in contact. After the lapse of a few moments the surface of the steel will be found to present a very beautiful prismatic appearance; it is then removed, and after having been washed, the operation is finished.

Having given an outline of the process, I will now proceed to give in detail the mode of setting up and working the experiment.

A constant battery of three cells will first be required, and if the reader does not happen to have one in use, he can soon set up a Daniell battery of three cells in the following manner: First procure from the cook three stoneware jars—salt jars will answer admirably, the inside measurement of which is about 5 by 4 inches—then obtain from an electrician's three white close-grain porous cells, half the internal diameter of the outer jar and just a little higher. Now get a sheet of copper measuring 33 inches by 5 inches—presuming that jars of the above capacity are employed—and cut it into three pieces measuring 11 inches each, a piece of stout copper wire being soldered to each portion, or a bit of strap copper may be simply riveted to them by means of copper nails, thus saving the trouble of soldering. Each of these sheets must now be bent to the form of a cylinder and placed in the stoneware jars.

A rod or cylinder of zinc the same length as the height of the porous cell, is now suspended in each of the same by the following means: Take a disc of wood 3 inches in diameter, and cut a circular hole in

the centre of it, just sufficient to allow the zinc to pass through; then take a copper wire and bend it round the zinc at about an inch from one end, and fit it in position by means of a little solder; now pass the zinc through the hole in the wood, when it will be seen that the copper wire forms a stop, and thus allows the zinc to remain suspended in the porous cell. After a conducting wire has been soldered to the zinc it should be amalgamated, which can be done thus: Wash it first with a little caustic soda, and then rub it with dilute sulphuric acid, using a piece of felt; pour some mercury into a saucer and rub it over the entire surface of the zinc by means of the felt, never leaving off until it is entirely covered with the mercury. It may now be placed in position in the porous cell, which is then stood in the centre of the stoneware jar surrounded by the copper cylinder. Having thus fitted up the three cells, they are next ready for charging, which may be done as follows: Make a saturated solution of sulphate of copper for the stoneware cell, by adding fresh crystals to the warm solution until it refuses to dissolve any more; this solution for the outer cell must be kept at a constant strength by adding fresh crystals to a quantity suspended in a muslin bag at the upper part of each cell. The inner porous cell should be filled to a little higher than the outer one, with a solution composed of sulphuric acid one part, water twenty parts. The wire from the zinc of the first cell must be connected with the copper element of the second. Then, again, the zinc of the second is attached to the copper of the third, thus leaving a wire from the zinc at one end free, and from the copper at the other. The battery is now ready for immediate use. I have given these particulars for the benefit of those who may wish to try this experiment, but do not as a rule employ a battery.

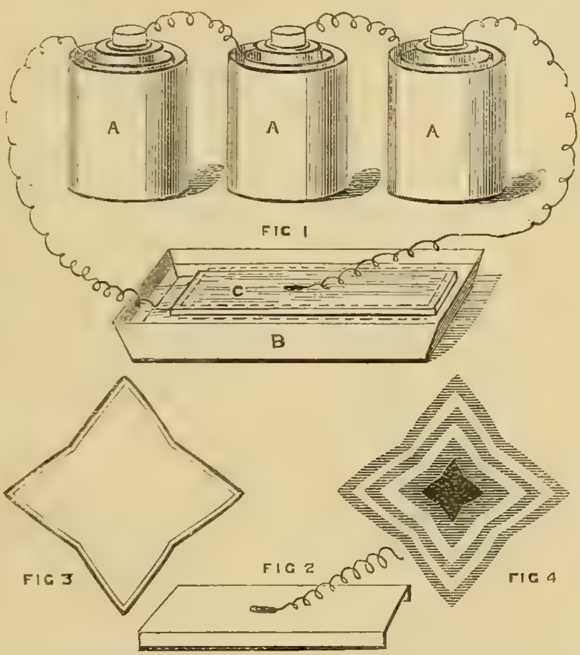


FIG. 1.—METHOD OF FITTING UP APPARATUS—A, Battery; B, Tray or Dish; C, Steel Plate. Dotted Lines show position of Copper Plate. FIG. 2.—COPPER PLATE WITH WIRE. FIG. 3.—WIRE DESIGN. FIG. 4.—APPEARANCE OF METALLOCHROME.

Now procure a shallow dish, and fill it with the following solution:—Caustic Potash, 6 drachms; Distilled Water, ½ pint; Dissolve and add, Litharge, 4½ drachms. Boil the mixture for half an hour, then allow it to settle, filter into the above dish, and add half a pint of cold water. Place a polished plate of steel at the bottom of the dish, and to this attach the wire from the copper element of the cell; and then get a sheet of copper about the same size as the inside of the dish, bend the sides over so that it does not touch the steel plate when placed in dish; connect the wire from zinc element to plate of copper, Figs. 1, 2.

As the current passes it causes the decomposition and deposition on the polished steel plate. As soon as the desired shade has been reached, it should be immediately removed and washed in clean water. On looking at the plate by a reflected light it will be found to possess all the prismatic tints. It is due to the per-oxide of lead being precipitated in different degrees of thickness, and the polished steel reflecting the light through it, thus producing these varied tints, which will be seen to perfection by holding the plate with its back to a window, and then placing a piece of white card so as to reflect the light upon it. It takes a great deal of polishing to remove the film thus formed.

If the plate is allowed to remain in the solution after the desired tint has been reached, the most beautiful tints will be lost, and it will most likely appear almost an even colour of red, brown, or green. Different designs may be produced upon a polished steel surface by twisting a piece of thin copper wire to any desired shape, and employing that in place of the sheet of copper, of course attaching it to the zinc element of the battery; but it must not quite touch the surface of the steel plate, see Fig. 3. A saturated solution of acetate of lead (sugar of lead) may be employed instead of the above, if desired.

Thinking that a knowledge of the above process might be of utility to those readers of AMATEUR WORK not already acquainted with it, I have endeavoured to explain the simple means by which they may produce these beautiful prismatic colourations known as metallochromes.

MODEL ENGINE-MAKING.

By JOHN POCOCK.

VII.—SCREW MAKING AND SCREW BUYING—WHERE TO BUY SCREWS—PLUG TAPS—PISTONS—ANOTHER METHOD OF MAKING PISTON—SLIDE VALVE.

BEFORE proceeding with the construction of our model, I have another correction to make, in addition to those kindly pointed out by F. A. M. on page 566 of the last volume.

Messrs. Hughes and Swift who furnished the castings for the model now being described, write me that they do not supply a connecting-rod with their set of castings for a horizontal model engine, this piece being usually made from a forging. The connecting-rod shown in Fig. 48, page 449 of the last volume, belongs to a set of castings for a vertical model. The two sets were sent to me mixed together in one packet, hence the error. While on this subject, I may say that I think it would be much better if all sellers of castings were to supply such indispensable portions as connecting-rods, and crank-shafts included in the set, making the price of the set of castings proportionately higher. As a rule, amateurs don't like to be suddenly pulled up in their work by finding they are minus some essential part, and must wait a couple of days before they can get it.

It is not, as a rule, worth while for an amateur to make his own screws, except when only one or two of some special size are required ; but, on the other hand, it is not always easy to procure screws suited to one's own screw-plate, if the latter is not standard thread ; neither are screws of standard thread everywhere obtainable. Moreover, I must warn my readers against ordering screws, say, of different lengths and same diameter, under the belief that only one pair of taps would be required. As a matter of fact, one maker to whom I applied, informed me that his screws of $\frac{3}{32}$ inch diameter and $\frac{1}{4}$ inch length were of a different thread, and required consequently a different set of taps to those screws which were $\frac{3}{32}$ inch diameter and $\frac{3}{8}$ inch in length. I have also received taps which when measured with a micrometer were found to be very perceptibly smaller in diameter than the screws for which they were supposed to be intended.

Under these circumstances, the amateur will find it far better to obtain screws of Whitworth standard thread, and these may be had of Messrs. Davies and Timmens, Screw Manufacturers, 24, *Charles Street, Hatton Garden, London, E.C.* They are sold in quantities of a quarter gross and upwards. Nos. 134, 144, and 147 will be found most useful sizes to keep in stock, and cost by the half-gross 1s. 6d., 1s. 8d., and 1s. 9d. respectively, and the postage for the gross and a half would be threepence. The prices per quarter gross are rather higher, and per whole gross rather lower, in proportion to those given above.

Now as to taps. A screw-plate which will suit the above quoted numbers of screws, may be obtained from Messrs. Buck and Hickman, 280, *Whitechapel Road, E.*, for 7s. This screw-plate is not sold as a Whitworth, but will prove to be the same thread. It has twenty-seven holes, and with it are sold a set of taper taps.

Plug taps the amateur must make for himself They should not be like those usually sold, which are made from steel, the same size as the tap required. This plan will answer for taps of fully $\frac{1}{8}$ of an inch and upwards, but all taps under $\frac{1}{8}$ of an inch should be made from $\frac{1}{8}$-inch steel. The steel should be turned or filed down to the required size over the length that is to be screwed, but the thicker portion must graduate into the threaded part, and there must be no sharp angle. The other end of the steel should be filed to form a tang, as seen in Fig. 62, and after the tap has been hardened and tempered, it should be fitted into a bradawl handle ; it will then be found far more handy to use, and will last much longer than the little pieces of screwed steel wire to be purchased at the shops for 3d. and 6d. a piece.

Having at various times experienced considerable difficulty with the screws obtained from different sources for the reasons indicated above, I have recently been at some trouble to go fully into the matter for the benefit of my readers, and I have now presented them with the results of my investigations.

But to return to our subject :—

The piston of our model engine may now be turned, or, of course, this might have been done equally well at any former stage after the boring of the cylinder was finished. If there is a chucking tenon on the piston, it may be turned up and bored and screwed for piston-rod while in the lathe. For the piston-rod, a piece of straight steel about $\frac{5}{32}$ of an inch in diameter and 5 inches long may be used, and this should be screwed into the piston while the latter is still in the lathe, so that we may be sure it is screwed in fairly straight and square.

If the piston has no tenon piece, however, it may be bored, the piston-rod screwed in, and the end of the rod centre-punched, when the piston may be turned up between the lathe-centres, the driving-carrier being placed on the piston-rod.

The piston when finished should be a good fit in the cylinder. It should be $\frac{1}{4}$ of an inch thick, and a groove $\frac{5}{32}$ of an inch wide and $\frac{3}{32}$ deep should be turned in it to take the packing. Fig. 63 shows the piston and piston-rod when finished.

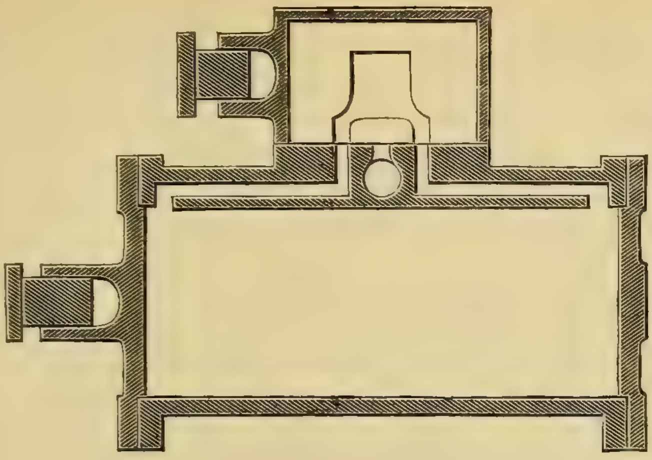


FIG. 67.—SECTIONAL VIEW OF VALVE IN POSITION.

Another method of making the piston is the following, and for this method the piston is to be made in two parts, one part as shown at A, Fig. 64, the other part forming the bottom plate, shown at B in the same figure. A cast gun-metal ring will be required having an inside diameter rather less than the diameter of the groove in the piston, and an outside diameter rather larger than the diameter of the cylinder. (In larger engines two rings are used, these being bored eccentrically; and when the cylinder is of brass or gun-metal, the rings are of cast iron.) The two parts of the piston must be screwed together with three small screws through the bottom plate. Of course, screws with bevelled heads should be used so that they may be driven in flush with the surface of plate; the piston-rod is then to be screwed in and the piston turned up as already described. The ring must be chucked in a recess turned in a piece of wood screwed on to the face-plate in the same manner adopted for chucking the cylinder covers.

The inside of the ring is to be turned out to the same diameter as that of the groove in the piston. The sides must also be turned up square, the ring being reversed in its wooden chuck so as to get at the other side. Thus far finished, the ring should be of just such a width that when tried in its place on the piston and bottom plate screwed on, it will be a good fit, not jammed immovably, and not having any shake. Now put the ring on piston, and screw on the bottom plate with a ring of paper between it and the piston ring, so that the latter may be tightly held. Place the whole between the lathe centres and turn down piston and ring, leaving the former a good fit to cylinder, and the latter a tight fit to same. Now take out the ring and saw through it at an angle of 45°. Replace the ring on the piston and screw up again, and the piston is finished, the spring of the ring keeping it pressed against the sides of the cylinder, and thus obviating the necessity for any other packing. Fig. 65 shows this form of piston completed. When two rings are used, the saw-cuts are placed, upon opposite sides of the piston, thus preventing any loss of steam through either division.

A further development of this form of piston is one in which steam is admitted to a groove in the piston under the rings, the pressure of the steam thus helping to make the piston steam-tight. This form is valuable where the piston goes on working when the steam is shut off, as in a tram engine descending an incline, for the friction of the piston against the sides of the cylinder is thus diminished directly the steam is shut off, and any unnecessary wear of these parts is consequently avoided.

FIG 62

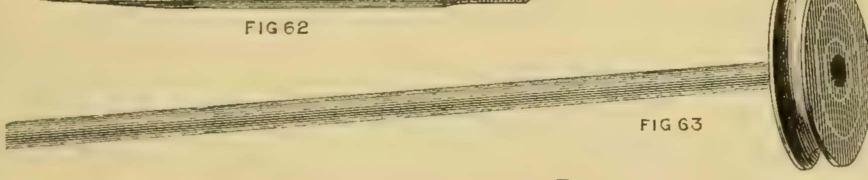


FIG 63

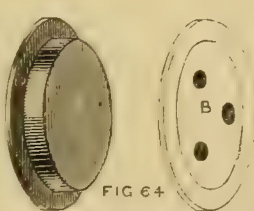


FIG 64

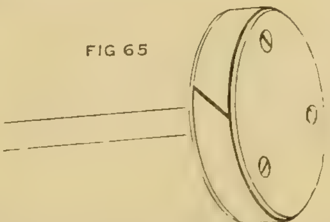


FIG 65

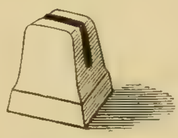


FIG 66

FIG. 62.—STEEL FOR PLUG TAP. FIG. 63.—PISTON AND PISTON-ROD WHEN FINISHED. FIG. 64.—PISTON IN TWO PARTS, (A) TOP PLATE, AND (B) BOTTOM PLATE. FIG. 65.—PISTON WHEN COMPLETE. FIG. 66.—VALVE SHOWING FILED SLIT IN BACK.

Before leaving this subject I may mention that the following proportions are given by Molesworth for the piston and piston-rod of a high-pressure engine:—Depth of piston, ·25 of diameter

of piston; diameter of piston-rod, ·15 of diameter of cylinder.

The slide-valve may next be finished off. It should be filed up square and smooth on the outside, and the width reduced until it will work easily in the slide-valve chest. The interior of the valve should be cut out with a small chisel until it measures nearly the same in length as the distance between the inner edges of the steam ports. The metal at each end must, of course, be left the same thickness when the valve is finished, and the total length of the valve should be such that when the valve is placed over the ports it will extend a very little beyond the steam-ports at each end. This extension beyond the steam-ports is technically called the "lap" of the valve, and serves to cut off the supply of steam rather earlier in the stroke of the piston than would otherwise be the case. The valve face should be rubbed down flat on the stone already used for the cylinder face, and a slit sawn or filed rather less than $\frac{1}{16}$ of an inch wide and $\frac{3}{16}$ of an inch deep in the back of the valve lengthwise, as shown in Fig. 66. Fig. 67, giving a sectional view of the valve in position over the steam-ports, will make the foregoing description quite clear.

(*To be continued.*)

SOME HINTS ON CONJURING APPARATUS.

By D. B. ADAMSON.

IV.—HOW I MADE MY CONJURING TABLE.

ONCE upon a time, or to be more explicit, soon after I began my initiation into the mysteries of conjuring, our friend the Professor was giving me some of the "Hints," which I endeavour to pass on for the benefit of readers of AMATEUR WORK who are not on terms of "free and friendly conference" with a real live wizard.

The evening was far advanced, and even the wonder-worker's tongue seemed tired, if it were safe to imagine anything so improbable. For some time, comparatively speaking, that is to say, during the full space of two minutes fifty-five seconds according to a clock that required setting back a few hours every night, silence, broken only by cats warbling unmelodiously in the back garden, reigned complete.

Turning to me the Professor said, not, as might be fancied, anything in disparagement of the feline concert, but, "You must get a table." It did not occur to me that a piece of apparatus or appliance for conjuring was referred to, and I wondered at words which from an ordinary person would not have been of much note; but from so verbose a man such a short utterance surely must have some serious intention, as had he been intent on mystery he would not have been so blunt in his remark; still, I did not understand what was meant. Ah, me! I was green, almost emerald-hued, in those days, with regard to the arts and devices of hankey-pankeydom. Did a conjuror say he used no apparatus, or give any explanation with a considerable amount of fiction mixed with a microscopical quantity of fact, I almost believed his account. You, dear reader, are, perhaps, in the same condition now; and to enlighten you a little I will explain that the table I was to get was one specially prepared for conjuring purposes, and without saying "You must," I gently advise you to do likewise.

Tables are to be purchased from all dealers in magical apparatus, but one that will do equally well for most tricks that an amateur is likely to perform can easily be made. The cost will certainly be less, which is an advantage. Another is, that the table will look more like an ordinary one than those usually sold, which are generally of rather an *outré* appearance, and do not accord well with the furniture of an English room. There is generally something about them which looks suspicious, or at least suggestive of their being out of the common run of tables. As an amateur principally performs in rooms, not public halls, this feature is not desirable, it being better to avoid, as far as possible, giving any idea of preparation.

To any who have learned the rudiments of conjuring, these remarks may appear unnecessary, but as they will be useful to those who are quite ignorant of the subject, and serve to indicate how anyone may become proficient in amusing his friends occasionally, they are given here; though as these papers are principally designed to show how apparatus may be made at home, it is, of course, out of the question to give instructions for performing the various tricks done by sleight of hand only. These can easily be learned from any good book on the art, or, better still, by a few lessons from a conjuror; but the acquisition of apparatus and appliances is a more serious matter. The prices for some of the best tricks are higher than many amateurs will care to go to, and it is always a difficult matter to ascertain exactly what the mechanism of a trick is unless the apparatus be purchased and pulled to pieces. For this reason the construction of conjuring apparatus is not often an amateur's hobby; though those who care to go in for it will find it interesting work, and will save their pockets considerably. I do not wish to affirm that the prices charged at conjuring shops are unreasonable; on the contrary, the value, as a rule, is good, so far as I have seen at the principal London dealers but from the nature of the business, prices may seem

disproportionate to the cost of materials and labour. It must, however, be remembered that the dealer not only supplies the apparatus but imparts the secret for a trick, and this may be the more valuable of the two. For example, Professor Proskauer, of *Oxford Street*, when showing me lately a trick rendered famous by a well-known performer, informed me that he had paid a considerable sum to ascertain how it was done, and though the requisites cost a mere trifle, it is not to be wondered at its being necessary to charge what at first sight might appear a high figure for them.

However, I am wandering from my subject. Before beginning to describe my table it may be well for you to know the special features of one for conjuring. One point in which it differs from an ordinary table, and the most essential, is that at the back, *i.e.*, the side furthest from the audience, there is a shelf a few inches below the top and extending from the table. This shelf, or as it is technically called, "servante," is used to hold articles, pieces of apparatus, or duplicates, of which spectators are not supposed to be aware till they are magically produced, as, for instance, in the well-known trick of finding a cannon ball in a hat. The ball till wanted remains on the shelf, its presence being unsuspected, whence it is secretly conveyed into the hat, and shown there in due course. Other cases in which the shelf is employed will be mentioned as occasion may arise. The top of the table should also be provided with traps for vanishing, and in some tricks restoring articles, as well as changing them; though as vanishing traps are the most useful, I do not purpose describing other sorts, and the various pistons sometimes required, at present. Perhaps on some future occasion I may explain how they can be made and fitted.

It will also be very convenient to have a table which will serve on occasion for a box, to hold the tricks required for an evening's performance away from home. This much being understood, the would-be table-maker and conjuror will be able easily to follow me in the description of a table I made some years ago. Though experience has taught me where various little improvements, which I will give as I proceed, might be introduced, I have never had any difficulty in performing my tricks with its aid, nor by confining myself to those not requiring pistons, etc., have I found any necessity for further mechanical appliances than the simple form of traps I made. In fact, the table has been a complete success, both for conjuring and domestic purposes. When not in use for conjuring it stands in a room as an ordinary piece of furniture, and is regarded as such by all my friends who are not acquainted with its peculiar construction, which, by the way, renders it useful as a work-table—I mean a lady's work table—the capacious box top being very convenient for Materfamilias to keep her sewing materials and such like things in.

For the benefit of Benedicts whose spouses don't sufficiently appreciate the various articles that emanate from the amateur workshop, let me record an observation my wife made a few minutes ago—it was, "David, I don't know whatever I should do without that table now, it is so handy for holding the children's (smallest of type and faintest of ink, Mr. Printer, please) stockings and things that want mending." As there seems to be a never-failing supply of these—a condition of affairs not unusual, I believe, where there is a large family of small boys, blessed with a careful mother—the table is generally devoted to other than its original use. In fact, it always has been, for before our olive branches gave occasion for such prosaic work, my wife, dear soul, used to consider it "so handy" for holding the needlework that developed into antimacassars and similar ornamental if troublesome adjuncts to easy-chairs and couches. The moral of this is that neither bride nor mother will say no to a conjuring table; therefore, with conscience clear from reproach that you might be making something more useful, set to work according to the following directions :—

Though it is called a table, a box on four legs would be a more exact description of what is required. Remembering this it will be as well to make the box first, adding the finishing touches which cause the resemblance to a table afterwards. The length of the box should be such that the legs can be put into it, and the width sufficient for the table to stand firmly. The depth must be enough to allow articles on the shelf behind to be concealed from the audience, but not so much as to arouse any suspicion from what is apparently the framing being too heavy. A useful size is 3 ft. by 1 ft. 8 in. on top by $6\frac{1}{2}$ inch deep. Any sound wood will do, but nothing is more suitable than baywood. The top and bottom must be of $\frac{1}{2}$ inch stuff, as may be the ends, back and front, though as it is as well for convenience in carrying not to have more weight than necessary, these will be better of $\frac{1}{4}$ or at most $\frac{3}{8}$ inch wood.

As it is quite immaterial how the parts of the box are put together, provided they are strongly joined, the easiest method may be taken. Screws alone will do, or brads with blocks fixed by glue inside the table. These, even if screws are used, will serve to strengthen the box and prevent it giving way.

In case any do not know what is meant by "blocking," I show this in Fig. 1, where A is the block. A ready way of making them is to get any lengths of wood, about an inch square, cut them into

convenient pieces, say 3 or 4 inches long, and split them across as shown by the dotted line in Fig. 2.

In making the box do not fix the back till the last, as this piece, or rather part of it, forms the shelf, which must be cut from it before fitting up. Fig. 3 shows how the back part is to be divided into five pieces. The ends are 6 inches wide at the top and 3 inches at the bottom, and in cutting them off the saw should be held on the slant that the edges may be bevelled, as A, A, Fig. 3. Now from the top of the centre-piece cut a strip an inch wide, also on the bevel, and another strip of the same width, but with square edges from the bottom. The largest piece is the servante, and the reason for the top and ends being bevelled is that no stops will be required to prevent this falling in when closed to form the lid of the box. In fitting these parts together as the back, due allowance must be made for the space caused by the saw cuts. These can be closed up by the end pieces not being brought up close to the ends of the box, and one strip being raised or lowered a little from the bottom or top of the box. When these ends and strips are glued on the back the box will have a hole exactly the size of the servante in it, and the box itself will be only a rough looking affair at the joints. Never mind that, though, as we will now begin to make it look like a table.

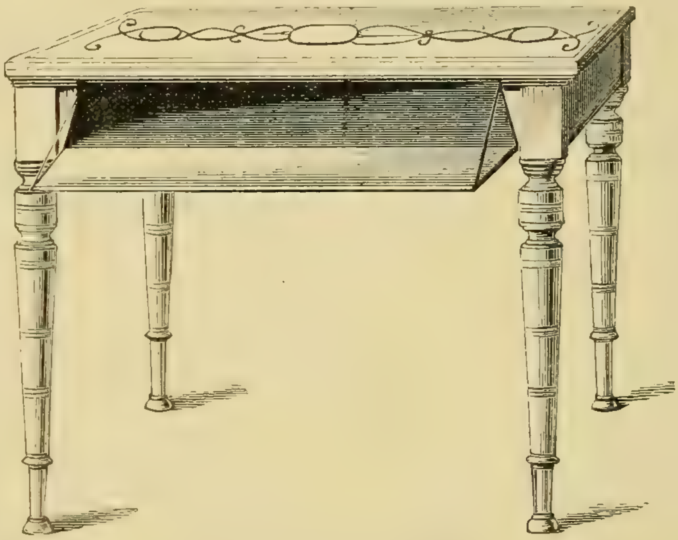


FIG. 8.—THE TABLE, COMPLETE.

Along the top edge of the box glue a moulding 1 inch square. A, Fig. 4, shows a suitable one. The corners should be neatly mitred, and the top of it should be not quite a sixteenth of an inch above the top of the box, B. Below this moulding another one may be fixed as shown, C, which also drawn full size. This, however, should not b carried round the back, at least not further than tl opening. If it were to go over this, the servante would have to be made narrower, and consequently not so convenient.

These mouldings being fixed, the substance of the legs must be decided on. Two inches to $2\frac{1}{2}$ inches will do very well, and accordingly eight pieces of wood of that width ($\frac{1}{2}$ inch thick) and long enough to extend from the bottom of the moulding, C, to $1\frac{1}{2}$ inches beyond the bottom of the box D, must be prepared. Each piece along one edge should be mitred so that when two of them are put together they fit exactly. They must be fixed in pairs at each corner of the box, as shown Fig. 5, where they represent the squares of the legs. Then the front, sides, and back of the box appear as the framing of a table let into them in the usual way. To give finish and to carry out this idea fix beaded strips along the bottom edge of the box as indicated by D. The servante may now be hinged (E, Fig. 3) to the back of the table, and either a lock, spring catch, or other suitable fastening fixed at F, to keep it up when not in use as a shelf. A piece of tape or chain should also be fastened from each end of the servante to the inside of upper part of the box to keep it level during a performance.

The upper part of the table being so far ready the legs can be attended to. It is impossible to state what the height of the table should be, as it varies for different people. Bearing in mind that the shelf is to hold things unknown to an audience, and that the said things have to be produced unobserved, it will readily be conceived that it must not be so low that the performer would have to stoop, nor yet so high that he would require to raise his arm to pick up anything from it. The right height, therefore, is that at which the performer can do this without exciting suspicion, as he best may when with the arm hanging straight, the lower part of the closed hand just touches the top of the servante.

Any plain style of turning will do for the legs: that known among cabinet-makers as the Early English will be as good as any, and better than some, as its members are small and well in accord with the mouldings I have shown. In the centre of the top of each leg should be a $\frac{3}{4}$ inch pin long enough to go through the bottom of the box, with a thread to screw into a block $2\frac{1}{2}$ inches by $2\frac{1}{2}$ inches by $1\frac{1}{2}$ inches. The blocks must be fixed into the spaces behind the corner pieces and under the bottom of the box, the

thickness of them being cut away from two sides, so that when the legs are screwed to them each turned part and the square above it looks like one piece of wood; or, in other words, it would not do for the lower part of legs to be half an inch or so out of position with regard to the upper.

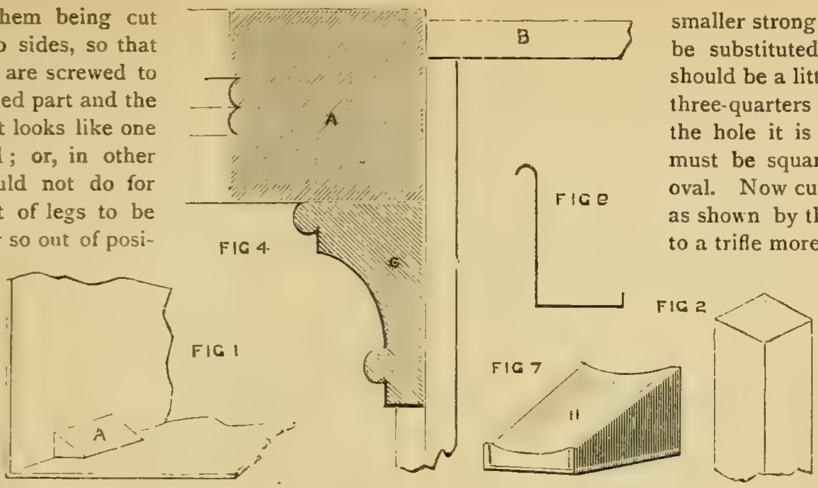


FIG. 1.—MODE OF "BLOCKING" BOX. FIG. 2.—MODE OF CUTTING BLOCKS. FIG. 4.—MOULDINGS ROUND TOP OF BOX. FIG. 7.—INCLINED PLANE FOR BRINGING THINGS PASSED THROUGH TRAPS ON TO SHELF. FIG. 9.—SUBSTITUTE FOR SERVANTE ON TABLE.

With the exception of the traps, which are not absolutely necessary, being only of use in certain tricks, the table may now be considered complete "in the white," *i.e.*, without the polishing and lining. Two traps will probably be enough for the amateur conjuror; but I should recommend three as more convenient occasionally. Two of them may be small for vanishing oranges, eggs, and such like, the other being for larger articles, rabbits, etc. Reference to Fig. 6 will show the disposition and arrangement of the traps on the table top. The smaller traps, lettered F, F, are two holes 4 inches square, or they may be round if preferred: G, the centre hole, is about six inches by eight inches, either as shown or oval. As covers for these holes pieces of zinc of fair substance, say $\frac{1}{16}$ inch thick should be used, though for the smaller strong cardboard may be substituted. Each piece should be a little larger, about three-quarters of an inch, than the hole it is to cover, and must be square, not round or oval. Now cut down the top as shown by the dotted lines to a trifle more than the depth of the thickness of the metal, making the sunken surface quite smooth and level. The metal being laid in these recesses should slide easily backwards and forwards, exposing or covering the holes. Near the front edge of each cover run a piece of wire through it to form a stop on the lower side, and a small projection on the upper, with which a finger can readily pull back the trap when required. My table has small round-headed screws for this purpose, the heads only being above the surface. Next paste or glue a piece of stiff brown paper, buckram, or thin cardboard across the recess into which the metal slides when drawn back, to prevent the cloth with which the table is to be covered from sagging. The traps are now in working order, but to render them less noticeable they and the table top should be covered with cloth the

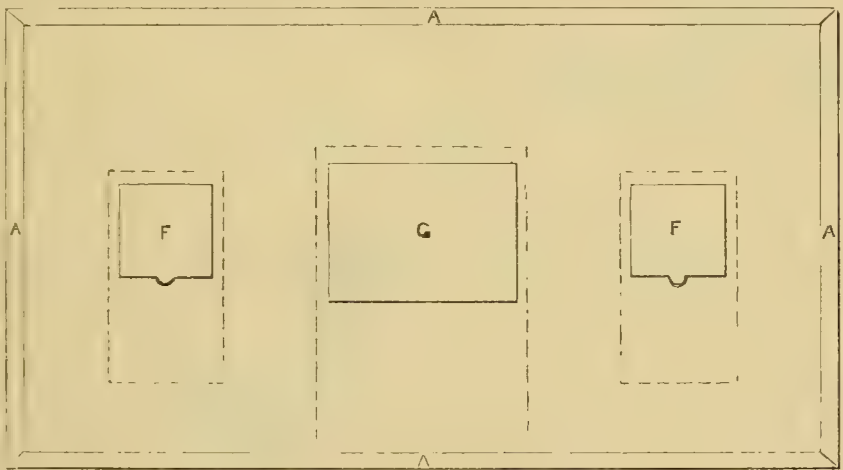


FIG. 6.—TOP OF TABLE, SHOWING TRAPS.

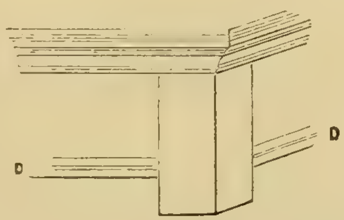


FIG. 5.—PIECES OF WOOD FORMING TOP OF LEGS.

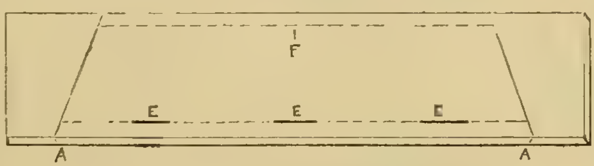


FIG. 3.—ARRANGEMENT OF BACK OF BOX.

same as a card table. Dark cloth is best, and it should go close up to the moulding A, being pasted or glued down thoroughly all over. The pieces over the holes should be cut out and stuck on to the slides, so that when these are closed no irregularity will be noticed, though, as a matter of fact, they are slightly sunk below the level of the rest of the cloth, to allow them to be drawn back under it without any hitch.

Unless the slides run very evenly and noiselessly they are apt to interfere with the neat execution of any trick requiring their use, so great care should be taken to have edges, etc., smooth. The corners should also be slightly rounded; and it is a good plan to have a little coloured braiding or stitching worked on the cloth round the traps, though this ornamentation should not form part of a design, covering more of the top than just round the holes. On no account must any decoration be on the cloth attached to the slides.

For tricks in which it is desirable to regain possession of an article that has been vanished, some means of getting it on the servante must be adopted. One method is to have a small tray or box under the trap with a piece of string or thread attached, one end of which lies on the servante and allows the box to be drawn back to the performer's hand. Another way is to arrange a piece of silk or alpaca to form an inclined plane from the trap to the servante. This is preferable to the other, as the article wanted comes of its own accord to the shelf. Fig. 7 suggests the construction, H being the piece of silk. If this is not used something soft should always be placed under the traps to prevent sound from anything falling through them, and for the same reason the servante should be lined with woollen baize or something of the sort. To receive small things dropped on to it, such as rings, coins, a small box or tray lined with wadding will be found very convenient; and to prevent things rolling off it is as well to have a small raised beading round the edge of the servante. To cause things laid on the traps to vanish without the performer being at the table, it is only necessary to fix one end of a piece of fine silk to the lower part of the stop, and to have the other handy on the shelf or table. The performer has then only to walk back the length of the thread, which on being pulled when required, will open the trap and allow anything on it to disappear. When vanishing a rabbit or living thing it is necessary to have a box under the trap to prevent the animal wandering on to the servante. Were it to do so, the amusement caused by its appearance would not be the performer's.

All that now remains to be done is to finish the table, which may be stained black and wax-polished. This will be better than if French polished, as being dull it will not show marks so distinctly, and it can be more easily kept in order. The wax-polish is made with bees-wax and turpentine, the former being melted and a little of the latter added to it while hot. When cold it can be applied with a brush or rag, and plenty of elbow grease used till the gloss is sufficient. The wax-polish when cold should be about the consistency of ordinary butter or lard, and it should be sparingly applied. When finished, the table seen from behind will look as represented in Fig. 8.

Instead of using the shelf at the back of the table, it may occasionally be convenient to have a substitute. One that is easily made and not at all likely to excite suspicion when judiciously manipulated, can be arranged for adjustment to the back of a chair. It consists simply of two pieces of strong wire bent as shown Fig. 9. The upper hooks are put on the chair back, while the lower support the board that does duty as a servante. Of course the back of the chair is turned away from the audience. An antimacassar or cushion properly placed will sufficiently hide the hooks, shelf, and contents.

A CHEAP READING STAND FOR INVALIDS.

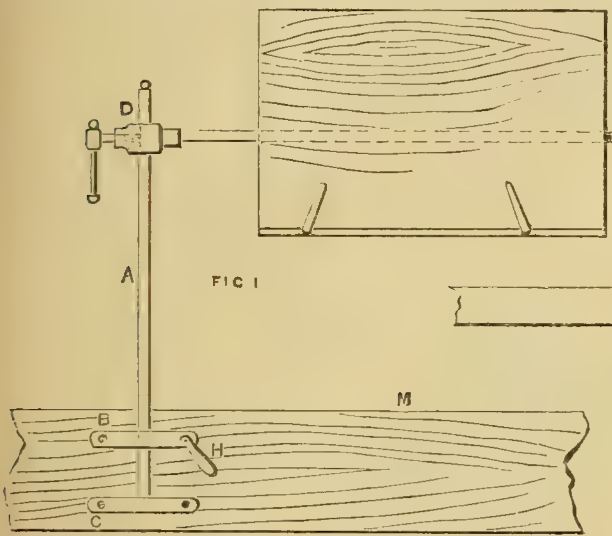
By J. L. DWYER.

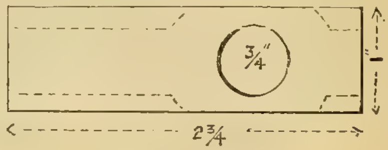
ON my visits to a lady, an invalid friend of mine, I was often struck by her helpless condition; and the sight of the poor sufferer, quiet and patient in her almost total helplessness, put a good desire to help her into my heart, which God was pleased to bring to good effect. She was constrained to lie on a couch from year's end to year's end, with very little recreation. I noticed that holding a book tired her, and so I contrived while sitting near her, and made in a few hours at home, the machine I now undertake to describe.

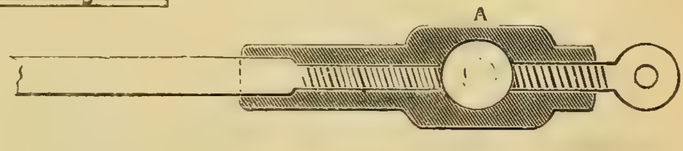
I hope few of the readers of AMATEUR WORK require it as urgently as my friend, but it can easily be attached to a chair or made to stand by itself, and as such it would be a welcome addition to most of our houses. I may put down the cost as sixpence; but it really cost me nothing, as I made it of scraps lying about the workshop; but I am sure anyone could get the few pieces of iron and little table for that modest sum.

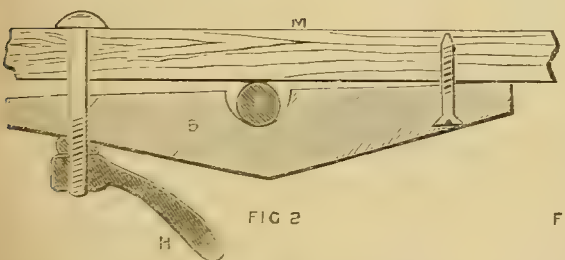
Fig. 1 is an illustration of the whole thing laid out to greatest advantage, *i.e.*, so that we can see every part, and the most at that. M is the side of the couch, to which is secured the pillar, A, by the two pieces, B, C. These pieces require a little notice; they are shown on a larger scale, Fig. 2, which shows B, and how it is fastened to the side of the couch, and

the handle for tightening; B and C are made of oak 4 inches long by $\frac{3}{4}$ inch thick by $1\frac{1}{2}$ inches, centre tapering to $\frac{3}{4}$ inch. There is a hollow cut out as shown in which the pillar stands. That of C allows the pillar to revolve freely, but is not quite across, so that the pillar cannot drop through. When B is placed against the side of the couch the hollow engages the pillar before the flats come against the wood, as shown in Fig. 2. I screwed one end against the couch, leaving a large hole in which the screw works freely, and most troublesome; but it would be easily managed if a forging could be procured. In my case it was out of the question, so I proceeded thus: I drilled a $\frac{3}{4}$ inch hole an inch from the end of a piece of 1 inch square iron; I then centred it, and turned down as shown by the dotted lines, Fig. 3, leaving the turned parts $\frac{3}{4}$ inch thick, and from the edge of the hole $\frac{3}{4}$ inch to one end, and $1\frac{1}{4}$ inch to the other. The short end I bored $\frac{5}{8}$ inch and tapped, and the long I bored $\frac{1}{2}$ inch for $\frac{3}{4}$ inch, and tapped the rest $\frac{5}{8}$ inch, to screw









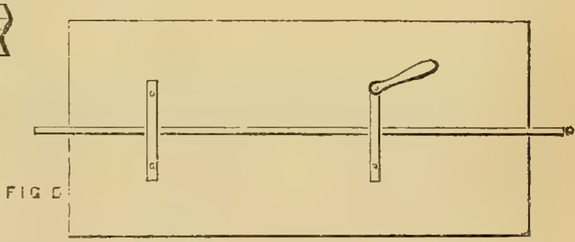


FIG. 1.—ENTIRE STAND, SHOWING PILLAR, ARM, AND TABLE. FIG. 2.—CLAMPING ARRANGEMENT FOR PILLAR. FIG. 3.—PLAN OF PIECE D, MADE OF 1 INCH SQUARE IRON. FIG. 4.—PIECE D, ARM, AND SET SCREW. FIG. 5.—DIAGRAM SHOWING HOW HANDLES ARE TURNED OUT OF SQUARE IRON. FIG. 6.—BACK OF TABLE SHOWING MEANS OF CLAMPING BY HANDLE.

to secure the other end there is a $\frac{1}{4}$ inch bolt coming from inside with a little handle, so that by turning the handle the table may be locked in any position. The nut would do instead of the handle, but I like always to have such things self-contained; as it would be very inconvenient for an invalid to go tripping about the house for a spanner. I hope I have made myself quite clear in this matter, as the same plan is used to regulate the table to any slope.

The pillar, D, is made of iron 18 inches long by $\frac{3}{4}$ inch thick, with a nice knob turned at the head; it is turned bright and polished. The piece D was the end of arm into, as shown in Fig. 4. The arm, E, is $\frac{1}{2}$ inch round iron, polished, and with a knob at the end, and 2 feet long.

The table is a piece of elm, 9 inches by 14 inches $\frac{1}{2}$ inch thick, and it is secured to the arm as the pillar is to the couch. I may mention that the little handles are made by turning $\frac{1}{2}$ inch square iron, as shown by the dotted line Fig. 5, leaving a piece square where the tapped hole is; they are each 3 inches long.

At the near edge of the table is a ledge an inch high and $\frac{3}{8}$ inch thick, G, having a couple of slips made of hammered brass, and fastened down by

screws tightly driven in, with little washers to prevent rubbing against the ledge.

The table of my stand I French polished, and everything was very nicely finished, and a cause of joy to me, and of very great thankfulness to my friend.

As I said before, it could be easily fitted to an easy-chair, or by making the pillar about 3 feet 3 inches high, and fastening it into a heavy foot, it would be removable to any position; or by making the pillar still higher, it would do occasionally for a music stand. In the latter case I would make half of the pillar hollow, of gas tube, and the other half to fit into it, with a set screw to fasten at any height. The difficult piece, D, could be replaced by a four-way gas joint.

NOTES ON NOVELTIES.

By THE EDITOR.

29. "THE MOLOCH OF PARAFFIN." 30. PENLEY'S PATENT PEN GUIDE. 31. "THE JOURNAL OF DECORATIVE ART." 32. CATALOGUE OF SCIENTIFIC AND TECHNICAL BOOKS.

29. THE MOLOCH OF PARAFFIN.—This is a very able and instructive pamphlet on the Petroleum Question, by Mr. Chas. Marvin, the author of several works of the utmost importance and interest on the operations of Russia in Central Asia—books which should be found in every public and private library throughout the country, for there is no man, Arminius Vambéry alone excepted, who from personal knowledge and inquiry, understands the Central Asian Question so completely, and is competent to speak with authority about it, as Mr. Marvin, speaking of whom Vambéry declares:—"The leading authority of the English Press on the Central Asian Question is Charles Marvin, a man of iron industry, who has wielded his comprehensive knowledge of the region in such a manner as to render eminent service to his country. Equally competent to write on subjects of social importance as on those which affect our interest and well-being as a nation, Mr. Marvin has taken advantage of the rapidly increasing use of petroleum as a source of light and heat, to show how dangerous it is unless it be burnt in lamps, properly constructed on safe and scientific principles, which will render those who use them secure against the accidents which may arise, even from such apparently trivial causes as attempting to blow out a lamp, or its accidental upsetting, which, unimportant as they may seem, brought about the almost total destruction of Chicago by fire, and have caused many conflagrations of lesser extent, and loss of human life to the extent of about fifty per annum in London alone, to say nothing of the United Kingdom at large, and all parts of the world in which petroleum is burnt. Mr. Marvin's pamphlet, "The Moloch of Paraffin," is sold at 1s., and published by Messrs. R. Anderson and Co., 14, *Cockspur Street, London*, and I strongly recommend its purchase and perusal to all readers of AMATEUR WORK who use petroleum for lighting purposes. Discoursing of "death in the lamp," Mr. Marvin first takes occasion to show how rapidly the consumption of paraffin, or mineral oil, has increased among us since its first introduction to public notice in 1850, and he speaks of the difficulties and dangers of storage, to meet which, recourse has been had to special legislation, though they are far less than those arising from the use of badly contrived and constructed lamps which are allowed to be sold in thousands, without so much as a caution respecting their danger and their insuitability for the purpose for which they are intended. A caution, however, has now been given by Mr. Marvin, who shows in his pamphlet, by diagrams and the assistance of a little colour, the points in which the cheap lamps and those most commonly used are defective, the danger arising from blowing out lamps, the necessity that exists for the provision of safety lamps that may be blown out and knocked over without any fear of fire or explosion; and he finally shows that there is such a lamp in existence in the Defries lamp. Mr. Marvin—possibly having regard to the fact that if you mention any article of commerce in a paper or magazine, and say where it may be obtained, and for how much, people of a certain turn of mind will at once conclude that you have been bribed to do so—has omitted to mention where the Defries Safety Lamps and Safety Oil can be bought. Happily not having the slightest regard to such opinions, let me say, in hope that the information may be of use to many, that they can be bought wholesale from the sole manufacturers, the Defries Safety Lamp and Oil Company, Limited, 43 *and* 44, *Holborn Viaduct, London, E.C.*, and retail from most dealers in lamps and special retail agents in London and different parts of the country, at prices ranging from 4s. 6d. upwards. If any intending buyer finds difficulty in procuring one of these lamps in his own town or neighbourhood, I may venture to say that an application to the Company will soon put him in possession of the name of the nearest agent, and lead, perhaps, to the appointment of an agent in the town or locality in which he resides. One cannot do a much kinder act to his fellow-men than to make the existence of the Defries Safety Lamp as widely known as possible.

30. *Penley's Patent Pen Guide.*—I have received from Messrs. E. Wolff and Son, 55, *Great Queen Street, London, E.C.*, a sample of their new Patent Pen Guide, the invention of Mr. Penley, an experienced writing-master, and one which seems well calculated to aid the teacher in bringing the pupil to understand the proper method of holding the pen when writing, and to assist the latter in the somewhat difficult task of acquiring the orthodox position of thumb and fingers when holding the pen. Messrs. Wolff and Son tell me that it has been practically tested with excellent results, and I can only say that, although I should not care to use a holder of this kind myself, seeing that I hold my pen in a variety of ways, yet, for boys and girls whose manner of handwriting is not yet natural and fixed, and for counting-house work in which absolute regularity of writing is desirable, the pen guide will, undoubtedly be found both helpful and useful, because it keeps the hand and fingers in a proper position when writing or learning to write, gives

the writer great command over the pen, prevents the fingers from becoming cramped, and, lastly, constitutes in itself a pen-rest when not in use. The engravings will show the form of the pen guide and how it is used, far better than any description in words that I could give. There are two flanges projecting from the holder. The end of the second finger, as may be seen from Fig. 1, is placed against the lower flange instead of against the penholder itself when the ordinary form is used, and thus affords the writer a greater control over the pen, which is kept in its proper position by the upper flange resting, but not pressing, on the same finger. The upper flange may be bent up or down to suit the convenience of the writer. The pen guides are sold by all stationers at 1d. each, or with extra finish, at 2d. each; they are, therefore, as cheap as penholders of the usual form.

31. "*The Journal of Decorative Art.*"—Mr. Henry Vickers, Bookseller and Publisher, 317, *Strand*, *London*, *E.C.*, sends me Volume VI. of the "Journal of the Decorative Art," whose utility for the purposes for which it is produced is only equalled by the beauty of its illustrations, of which it may be said that all are good, while very many, particularly the chromographs and large separate folding sheets are especially noteworthy for excellence of colouring, boldness of design, and niceness of finish and execution. The volume itself is accompanied by a series of loose plates, eight in number, contained in a neat and strong paper portfolio, exhibiting full-size working drawings of decorative work for panels, pilasters, architrave, and frieze, with borders of wild flowers. To describe the contents of this desirable volume in their entirety would take up far more space than I can spare, but attention may be specially directed to the illustrations of the decorations of Eaton Hall, Cheshire, and of the seats of the Duke of Westminster, among which stand pre-eminent the beautiful panels for doors in the drawing-room designed by Mr. W. Sutherland, remarkable, among other points, for skilful conventional treatment of the blooms of the primula and marguerite; the bird panels from the ante drawing-room, after Mr. H. Stacey Marks, R.A.; and "The Court of Love," the frieze of the chimney-piece in the saloon, in which are figured eight pairs of lovers famed in history, with orange trees between each pair. I must not fail to call attention to an article entitled "Twelfth Night at Oxford," from the pen of Mr. Henry L. Benwell, comprising clever illustrations of the Act Drop, bordered with the armorial bearings of the various colleges—Olivia's Garden, A Room in Olivia's House, and An Olden Time Street, an Ideal Study, drawn from the artist's stage model by Mr. Benwell himself. All these illustrations would prove interesting and useful to all readers of AMATEUR WORK who are interested in scene-painting, for they are valuable both as copies and for the hints and suggestions that they afford. The centre of the Act Drop is a view of Iffley Mill, a picturesque and well-known spot on the Thames, not far from Oxford. The price of the volume, handsomely bound in cloth, with all the coloured plates, folding sheets, and full-size working drawings, is only 10s. 6d. I note only one thing in the volume to which I can take exception, and that is the continuation of the pagination from volume to volume. Vol. VI. commences with page 821, instead of beginning *de novo*, with page 1 in the usual way.

FIG. 1.—PENLEY'S PATENT PEN GUIDE, SHOWING MODE OF HOLDING THE PENHOLDER.

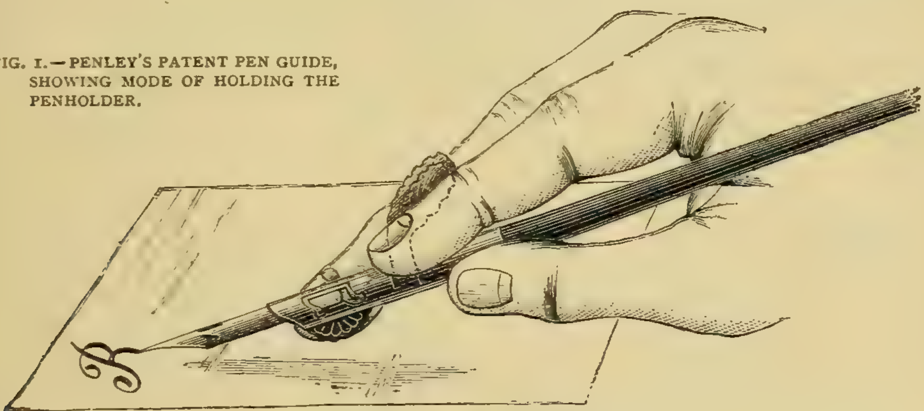


FIG. 2.—PEN GUIDE SHOWING FLANGES—FULL SIZE.

32. *Catalogue of Scientific and Technical Books.*—Messrs. George Philip and Son, 32, *Fleet Street*, *London*, *E.C.*, have just published, in demy 8vo, price 2s. 6d., post free, a work of 216 pages, entitled, "A Classified and Descriptive Catalogue of Scientific and Technical Books." The titles of books are alphabetically arranged under subjects. Readers of AMATEUR WORK will find this catalogue most helpful when they are in search—as many of them often are—of special books that treat on some particular branch of art, science, or manufactures, on which information is required.

AMATEURS IN COUNCIL.

For "Instructions to Contributors and Correspondents," see page 44 of this Volume, or Part 60, page 44.

Address Wanted.

Co. Cavan.—Please favour me with your name and address, as I have a letter to forward to you.—Ed.

Silver and Brass Plating.

C. B. B. H. (*Ballyhaunis.*)—Articles on Electro-plating at Home," from the pen of Mr. George Edwinson, appeared in Vol. I. of this Magazine. When he is more at leisure he will write further on plating in gold and nickel. A paper describing an "Electro Motor for Revolving Vacuum Tubes," appeared in Vol. IV., page 316 (Part 42). Mr. Edwinson has a paper in hand on the method of making an Electro Motor.

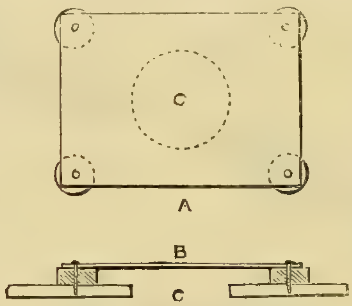
Equatorial Mounting of Reflecting Telescope.—Folding Sheet in Part 63.

*** I have to offer sincere apologies to my readers, both on my own account and for the Publishers, for an error in this Sheet which, in all probability has been noted and understood. Although the Sheet was prepared by myself, and given out on December 15, 1886, there was so much delay in one way or another, that proofs of the whole Sheet were not submitted to me until January 20, when it was too late to send any instructions respecting it, except by telegram. The error is that the two blocks of which Fig. 106 is composed are not properly fitted together. This defect was duly noticed and pointed out to the printer at the publishing office, but, unfortunately, the instructions given were not perfectly understood. It is only just and fair to the printers of this Magazine to say that it was not printed by them. All readers and correspondents who may write to me on this subject will kindly accept this as a reply to their communications, of which it will be unnecessary to take further notice.—Ed. A. W., Jan. 27, 1887.

Imperfect Sound of Harmonium Reeds.

B. H. J. writes:—"I am making a Harmonium with two rows of reeds, 8 ft. and 4 feet, for which I want to put 4 stops—8 ft. treble, 8 ft. bass, 4 ft. treble, and 4 ft. bass. The reed boxes being made by the same dimensions as in the Alexandre Harmoniums, the difference being that I have conveyed the wind from bellows to reed-boxes by a trunk, size 5¼ by 1½ in. (inside). My stops act upon four round holes on the bottom of the reed-boxes, the same as in harmoniums. Valve holes, 1¼ inches diameter; the pallets fit on the underneath of the valve holes, being, of course, inside the trunk. Four small pull-down wires act on the valves worked upon by the stops. The 8 ft. answers all right, except the bottom G sharp and A, which will not speak properly; G sharp will speak a harmonic note, and A will speak as if overblown (a kind of muffled sound but if the stop be pushed in until hole is almost closed, both notes will speak perfectly. Why won't they speak the same as the others when the stod is all the way out? The 4 ft. goes wel except one note—the bottom C. This note goes all right while the 4 ft. is being used alone, but as soon as the 8 ft. stop is drawn the 4 ft. bottom C will not go right; it speaks as if overblown. I have tried a difference in the weight of wind, but it only amounts to the same, and I have also taken the corresponding reeds from an Alexandre Harmonium, but when fixed, they act exactly the same as the others: that is imperfectly. The most curious part is, that if the partition be taken out of the 8 ft., thus uniting treble and bass, and bringing them under control of one stop or valve, the whole of the 8 ft. will go as even and correct as possible, the G sharp and A following as perfect as the others." [I have given B. H. J.'s inquiry above *in extenso*, that amateur harmonium-builders may perfectly understand the nature of his query, and the following reply.—Ed.]

W. D. writes, in answer to B. H. J.:—"I have never before known a case of imperfect sound in harmonium reeds, such as you describe. I have had notes speak overblown,



WOOD TO BE PLACED OVER VALVE HOLE.
A, Plan; B, Section; C, Valve Hole.

and have cured them by inserting a thin slip of tin or brass between the reed and soundboard, thus diminishing the area of mortise through the latter at the *heel* of the note, and also by altering the pallet so as not to allow so much wind to escape. The fact that the reeds from another instrument speak in the same faulty manner seems to clear the reeds from blame, or I should have thought they were most probably in fault; but, as it is, I am inclined to ascribe the fault to the winding of these notes. Firstly, I would advise you to see if there is any flaw or defect in the soundboard, then to take notice of the mortise, if the vibrator, when blown, touches the wood at any place; does the reed lay well and truly over the mortise? and then, though a most unlikely place, see if the pallet is in perfect order. Then take a piece of wood, ⅛ in. thick by 2½ in. square, as illustration, and bore a small hole in each corner, also take four pieces of wood 5/16 in. or ⅜ in. thick, with a hole through each. Fit this over the valve hole, as in the annexed illustration, the collars preventing it from closing the valve hole up—one under each corner. The wind will thus be deflected, and will strike the reeds obliquely. Should this fail, cut some strips of wood, 3½ in. long, ⅛ or ¾ in. wide, and 1/16 or ⅛ in. thick, and fix them edgewise between the reeds, projecting down into the trunk, thus enclosing each reed and separating it from its fellows, while dmitting the wind in perfect freedom. I cannot make any other suggestions without seeing the instrument, but hope that you may find some one or other of these expedients, all of which I have myself used, may prove successful." [Readers interested in Harmonium Building will be pleased to see that I have at last been able to place on my staff a contributor who is both competent and willing to write on the subject, and who is under engagement to write a series of papers on it.—Ed.]

Permanent Oil Paints in Tubes.

Art Student.—You will find all the information you ask for, and much more, in the "Artists' Manual of Pigments," price 2s. 6d., from Crosby Lockwood and Co., *Stationers' Hall Court.* However, for the benefit of yourself and others who may desire information on this subject I give a list of permanent oil colours, arranging them alphabetically:—Aureolin, Blue black, Burnt Roman ochre, Burnt sienna, Burnt umber, Cadmium yellow, Cerulean, Chinese white, Chromium green oxide, Chromium transparent, Cobalt blue, Constant white, Cyanine blue, French blue, Gamboge, Indian red, Ivory black, Lamp black, Light red, Madder carmine, Madder red, Mars brown, Mars orange, Mars red, Mars violet, Mars yellow, Permanent yellow (Newman's), Raw sienna, Raw umber, Sepia, Smalt, Strontian yellow (pure), Terra verte, Ultramarine blue, Ultramarine ash, Ultramarine grey, Ultramarine artificial, Vandyke brown, Venetian red, Vermilion, Yellow ochre, Zinc white. It should be remembered that the permanency of pigments is only a relative quality—for example, a pigment that is permanent under one condition, is often impermanent under other conditions of mixture and employment. These precise conditions are set forth in the above work.—H. C. S.

Dressing Skins.

H. H. B. C. S.—You will find full instructions for dressing skins in Mr. George Warden's papers, entitled, "How to Stuff and Preserve Birds and other Animals," in Vol. III., pp. 466 and 507, or otherwise, Parts 33 and 34 of this Magazine.

Fixing Electric Bells.

G. G. (*Catford*).—Fix the bell where you can best hear it when it is rung. On a wooden partition in hall, corridor, or passage, is an excellent position, because the sound is conveyed by wood. Have the battery in a cellar or similarly cool place. Run a wire from bell to battery, from this to the push, from push back to bell again. The push should be placed just where you want it. Do not inconvenience yourself by putting the push in an awkward spot to save wire. Wire is cheap, and a yard or two, more or less, will not seriously affect the ringing of the bell. The Léclanché cell is a good one for bell ringing, so is the Applegarth cell of corrugated carbon. Two cells holding a pint of liquid in each cell, will form a battery strong enough to ring an ordinary bell. Messrs. H. and E. J. Dale, 4, *Little Britain, E.C.*, supply materials for electric bells.—G. E.

Fret and Circular Saw.

GEOMETRIC.—Your arrangement will do very well if carried out properly, but the saw (circular) should overhang the bearing, or else you will have trouble in fixing and changing it. The connecting-rod for working fret-saw should be as long as possible. If you adopt my Saw Bench, as described in AMATEUR WORK, it would be better, as you could then work your fret-saw from the right hand end of spindle. If that is left-handed to you, the treadle could be reversed.—OLLA PODRIDA.

"Cabaret" Battery.

S. F. W. (*York*).—A full description of the method of making the "Cabaret" Battery, with illustrations of its various parts, is given in Vol. V., page 191 (otherwise Part 51), by Professor Marissiaux.

Translucent Paper Negatives.

F. H. (*Glasgow*) writes:—"In page 176 of the 'British Journal Photographic Almanac and Photographer's Daily Companion' for 1887 there is an interesting description of 'a new method of rendering paper negatives translucent.' As the substitution of paper for glass for negatives is of great importance to all amateurs, I write to draw the attention of 'ours' to the above process. The principal requisite is Craig's Medium for Bronze Painting, which has been repeatedly recommended by you in 'Notes on Novelties.' Having some of this medium by me, I have tried the above process according to the directions given, and the results are beyond my expectations. Those who give it a trial will have what I experienced—a delightful surprise. Hoping the importance of the subject will form my apology for troubling you." [To save readers the trouble of inquiry, I had better add that "Craig's Medium for Bronze Painting" is supplied by Mr. Walter T. Craig, Gold Leaf and Bronze Powder Manufacturer, *Miller Street, Wick, N.B.*, who will send detailed price lists of his preparations to any applicant on receipt of stamped addressed envelope.—ED.]

Transfer of Fretwork Designs.

A. M. O'D. (*Deniliquin, N.W.S.*) writes:—"Having employed a device for the transfer of fretwork designs to the wood, I have great pleasure in submitting it for the consideration of my brother amateurs. The simplest and best way, and by which the original designs can be saved for many times, is by tracing the design from the original copy on the wood by means of a sheet of ordinary black tracing or carbon paper; the marks left on the wood cut out with the saw cut, there is no damping or rubbing off required. I have your three vols. [Five Vols. are now published and on sale.—ED.] of the AMATEUR WORK, from which I have made many useful and handsome ornaments. I have made two Lily overmantels, fireplace fan, Japanese cabinet, and from the 'Decorative Carpentry' the overmantel on Japanese woodwork. You do not give any scale for Laker's designs. All fretwork designs we get out here are so small that they are of no use. I would be glad to find some new and large ones, although there's a disadvantage in working them, as the jaws of the saw won't take them more than 20 inches, and I have to cut and join them after." [When scale is not given, designs are supposed to be full size. It is not always possible to give designs full size; but it is a matter of no great difficulty to enlarge or reduce to scale, or even to adapt to suit space at command. I am glad to learn that the magazine has proved so useful to you. Booth Brothers' catalogue will reach you as easily from Dublin as from London. They will attend to your application, I am sure. The firm will answer the business part of your letter respecting transmission of Parts of AMATEUR WORK by Post.—ED.]

Photographic Enlarging Camera.

A. K. (*Bournemouth*) writes:—"As a new subscriber, allow me to tender you my best thanks for the very great help that the article on Photographic Enlarging has been to me. To my knowledge AMATEUR WORK has been the first to publish a series of practical articles on the above subject—that is to say, describing a really reliable apparatus, and at the same time giving full directions for its use. I was on the point of buying an enlarging apparatus, as advertised in the photo journals, the price of which would have been six guineas, when a friend of mine, who was aware of my intentions, showed me the September part (Part 58) of AMATEUR WORK. I thereupon set to work to make the apparatus, and being a fair amateur carpenter, this was not very difficult. I obtained from Messrs. Lancaster and Son, of *Birmingham*, a pair of 6 inch condensers mounted in brass for 10s.; and by advertising in the 'Exchange and Mart' I got a second-hand refulgent lamp (one of Messrs. Newton's 4 wick) for 10s. This was all my outlay, as I had plenty of wood by me (mahogany and pine), and the largest bellows I took from an old camera, making the smaller one myself without any very great trouble—I had made bellows before. I had a good half-plate portrait combination that answered very well for the lens. When the October part of AMATEUR WORK (Part 59) appeared I had almost finished the apparatus, and it was ready for use. For enlarging, I have been using some of Eastman's bromide paper, and have got some very good results already; therefore, being so pleased with my first results, I thought it only right I should beg you and Mr. Parker to accept my warmest thanks, for having been the means of saving me £4 16s. I may add that I have found the apparatus very simple and convenient to use, especially the easel, which answers capitally, and can recommend it to any of my fellow-readers. I have introduced your magazine to several of my friends, and if I can be the means of getting you some fresh subscribers I shall be only too pleased to do so. May I ask if you will publish some instructions for micro-photography? I should very much like to make a photographic camera similar to 'Rayment's;' could someone (perhaps Mr. Parker) furnish me with working drawings to scale? I have no doubt they would be welcomed by others. I see by your prospectus that Mr. Parker will contribute some articles on Electrotyping. Will Mr. P. tell me how to make an elastic mould insoluble? I look forward to the publication of these articles, as the subject is very interesting to me, and I am fairly successful with small coins. [Mr. H. E. Grantham, an old contributor to this Magazine, has arranged to take up the subject of Micro-photography in conjunction with a *collaborateur*, who possesses special knowledge and skill in this branch of art.—ED.]

Daniell Battery—Telegraph Form.

S. W. O. (*Croydon*).—A teak or pitch pine tray or trough, 5 feet by 6 inches, by 5 inches, divided into ten equal compartments by partitions of the same material. The bottom should be of 1 inch wood, 6 inches in width; the sides and ends of ¾ inch wood; and the partitions of ½ inch wood. The sides and ends must be let into a groove cut in the bottom board, well fitted therein, put together with hot pitch in the joint, and drawn down with screws passing through the bottom. The ends must be fitted into grooves cut in the sides, and put together in a similar manner. The partitions should only be 5½ inches in height, and must be fitted into grooves cut in the sides, and put together with hot pitch in the joints. Each cell must be subdivided by a partition of porous earthenware 5 inches in height, fitted into grooves cut in the sides of the tray, and bedded in with hot pitch or asphalte. All the insides of all the woodwork must now be coated with pitch or with asphalte, to prevent saturation of the wood by the zinc and copper salts. The outsides should receive two or three coats of varnish. Now get ten plates of zinc 5½ by 4 by ¼ inch, and ten plates of very thin sheet copper 6½ by 4 inches. Cut the tops of the copper plates down to 5 inches on both sides of a tongue 1½ inches wide. Solder nine of these tongues to nine plates of zinc, and thus form nine pairs of copper and zinc, destined to be hung by the connecting tongues across the nine wooden partitions. Into one of the sub-compartments at one end place the remaining plate of copper, and connect its tongue with a binding screw inserted in the edge of the end of the tray. At the other end, in the extreme opposite sub-compartment, place the remaining plate of zinc, and connect it by a tongue of copper with a binding screw at that end. Cover each connecting tongue and quite half an inch of each plate with Brunswick black. Rub some tallow over the top edges of *all* the partitions to prevent the salts from creeping over, then proceed to charge the sub-compartments. Fill each sub-compartment containing copper plates with copper sulphate crystals, and fill the zinc sub-compartments with water. Then pour water into the copper compartments until the crystals are covered. Each trough of ten cells thus constructed may have a cover of well varnished wood, and may be furnished with brass handles at the ends. The copper plates will thicken, and the copper solution become diluted as work proceeds. It will therefore be necessary to draw off some of the dilute solution occasionally, and replenish the cell with more copper sulphate crystals as required. Sufficient sulphuric acid will pass through the porous partitions by gradual percolation to excite the zinc plates.—G. E.

Glazing Paper.

O. B. P. (*Newmarket*).—You ask: "Is it possible for an amateur to replace the gloss on paper which has been dipped in water previous to printing?" The glazed or glossy appearance of paper after printing is produced by pressure applied by means of a very powerful hydraulic press, the sheets being inserted between glazed boards; or by a rolling machine, the paper being placed singly between sheets of zinc. As an amateur, you might do this on a small scale and for short numbers by means of a hot flat iron, the printed matter being between sheets of smooth paper laid on a level surface. Pass the iron quickly over the sheets with slight pressure.

My Marionnette Theatre.—Erratum.

Mr. Edward A. Leonard writes:—"It will be well to make a slight correction. Under the head of 'Arrangements for Lighting,' it was stated, p. 106, that the screws used were of the shape and size shown in Fig. 3. As my original drawing has been reduced in size by the engraver, it is necessary to say that the actual screws are 1¾ in. in length, and wide in proportion. Those used for the scenes (as mentioned on page 107) may be about the same size as in the figure. Further, in Fig. 4, page 105, the inscription should read: 'Front View of Stage showing Drapery attached to Frame (A), and Table (B), the Drop Curtain (C, C), and Curtains at Sides.'"

Amateur Mechanics' Association.—A Suggestion.

A. F. C. (*Bombay*) writes:—"Amateur Photographic Societies are so numerous in England that I have sometimes wondered at the non-existence of Amateur Mechanic Societies. I do not remember to have heard of single association of the kind, and yet in London and its neighbourhood at least such a Society would surely be of the greatest profit and interest. Though unlikely at present to profit through such an association, I venture to throw out the suggestion in the hope that it may be taken up by others. Perhaps among the readers of our magazine some one may be found with the leisure and the energy to undertake the organisation of what I think will be the first Amateur Mechanics' Association in England. If a sufficiently large number of amateur workmen could be got together, very pleasant and instructive reunions might, I feel sure, be organized, and, perhaps, in the course of time, a few of the most expensive and seldom needed tools and mechanical apparatus might be purchased for the general use of the members at the Society's head-quarters. Amateurs would be brought together for mutual advice and help. Novelties in the way of tools might be exhibited and criticised. One who happens to be the fortunate possessor of a screw-cutting lathe might be found ready to execute for a less fortunate brother amateur some little job requiring the use of that apparatus. The possible good of such a society is indeed almost infinite, and not the least might be the purchase of materials and tools at reduced rates. Members of the Photographic Society to which I belong are allowed a liberal discount on purchases made from one of the dealers in this city, and a similar arrangement might probably be made with regard to mechanical requirements in England. To secure such an advantage, it might be worth the while of those not resident in London to join the Society. With the association in full swing we may hope for records of its proceedings, and of papers read before it, which, if published in Amateur Work would be read with profit and pleasure wherever that magazine is in circulation."

Fretwork Strips.

Esor.—You cannot buy strips of fretwork of the dimensions stated, or indeed of any other special dimensions, ready made. They must be made for you. If any fret-cutter, whether professional or amateur, who is willing to undertake such work, will furnish me with his name and address, I will give publicity to it in this magazine. I venture further to suggest that workmen, whoever they may be, who are ready to execute fancy work, or work of any kind for those who cannot do it for themselves, should insert their names and addresses in our "Trades Directory," which appears in our red advertising pages, and keep them standing there. I am sure it would be to their benefit. You may apply to Mr. George T. Liddiatt, *Sharpness, near Berkeley, Gloucestershire*, who, some time ago, intimated to me his willingness to undertake work of this kind.

Geographical Journal.

H. H. B. C. S.—The Royal Geographical Society, whose offices are at 1, *Savile Row, London, W.*, publishes at intervals reports of its proceedings. A letter to the Secretary, C. R. Markham, Esq., C.B., F.R.S., will obtain for you all information as to price, etc. I am acquainted with no "journal or paper, weekly or otherwise, that reports such as Stanley's Work in Central Africa," or, in other words, a serial publication, weekly or monthly, that would gather up all the geographical information from day to day that now appears scattered about in newspapers, etc., and keep the public (or such of them that care for it) well posted up in geographical progress and changes, political and physical. If such a journal were well illustrated with reliable maps, it *ought* to pay, but whether it *would* pay depends entirely on the nature of its reception by the general public.

Stop Chamfer Plane.

Skiddaw Grey writes:—"The Stop Chamfer Plane you mention in 'Notes on Novelties,' Vol. VI., p. 141 (or otherwise Part 62), is the best in the market. I have had one for ten years, so it is not so new. If it is new to the London dealer, it is well known in the North. One I use most has a piece of brass at the end put on a bevel to fit the opposite stop, in case of cross grain, or the plane slipping, or the stops close together. I have a good many to make 3 inches between stops, and finish them off with plane without fear of injury to opposite stop. I send these few remarks as they may be useful to amateurs who intend making their own, as it is as easy to make and work as one with square end. I think 7s. too much for a plane of that description." [I am much obliged to you for your letter. I do not know every tool in use, as you may suppose, and when Messrs. Melhuish and Sons spoke to me about it, and asked for a notice, I supposed it to be one that they had recently introduced, therefore, recognizing its merits and being convinced that it was a plane desirable to describe for the benefit of amateurs generally, I readily noticed it, and your letter shows that I was right in doing so, and in my opinion of the plane.—Ed.]

INFORMATION SOUGHT.

Electric Apparatus for Lighting Lamp.

South Australian writes:—"I am anxious to make an attachment to alarum clock with electric bell, so that when the bell goes off it may light a paraffin lamp placed under a pot of water for shaving. Can any of the many readers of Amateur Work suggest any means?"

Jumping Dial for Clock.

F. A. D. H. supplements his request on this subject (for which see page 144) by writing:—"The following is the best explanation I can give about the Jumping Dial: The clock is without hands, and the means of telling the time is by two openings, one of which has number of minutes, the other hours. At intervals of one minute the numbers change thus: at 9.40 the 39 passes away and 40 follows into place of 39 as per diagram in margin."

9 | 40

Prices of Skins.

M. writes:—"Will any reader let me know where I can obtain the current market prices of hides and skins? Is there any weekly price list published?"

Syphon Tanks.

F. J. W. asks:—"Will some reader kindly give advice on construction of syphons (self-acting in tanks) for flushing purposes? Mine does not empty itself when water runs in in driblets; it requires a pailful thrown in all at once when nearly full to start it; if left to itself, the water rises to a certain height and then runs off as it runs in."

Ornamental Wrought Iron Work.

Scotus writes:—"Can any obliging reader of Amateur Work tell me of any book where I can find good examples of ornamental wrought iron work?"

Paganini's Guarnerius.

S. M. L. (*Goderich, Canada*) asks:—Can any of our musical amateurs tell me where a photo of Paganini's Guarnerius violin is to be obtained? I believe Mr. E. H. Allen had the above instrument photographed a year or two ago, an account of which was given in "Musical Times."

LETTERS RECEIVED UP TO FEB. 9.

S. M. L. (*Goderich, Canada*); W. G. G.; A. T. (*London, S.W.*); Ajax; Polisher; Clyde; R. J. F. (*Halifax, N.S.*); Only an Amateur; Stadt Dresden; Nil Desperandum; P. H. S. (*Brixton*); Anxious; J. F. S. (*Edinburgh*); C. W. V. (*Southgate*); Fat; M. C. D.; A. S. (*Battersea*).

MY MUSIC-STAND:
HOW I MADE IT.
By NEPENTHE.

THIS article will be found graceful, light, strong, and easily adapted to the comfort of a sitting or a standing player. Its component parts are (1) the three *posts*, $\frac{3}{4}$ inch square, "return beaded" on the outer edges, and 32 inches long, including the tenons, $\frac{1}{2}$ inch long and $\frac{1}{2}$ inch square, cut at their lower end to fit corresponding mortises in the *foot-plate.*

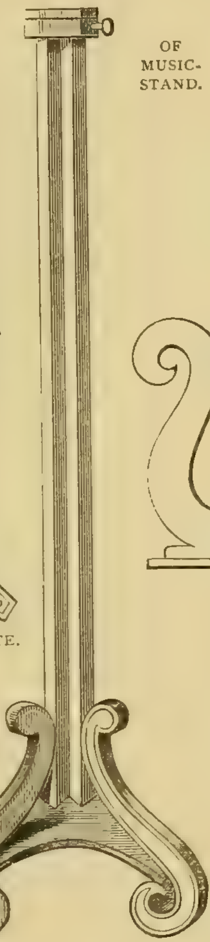


FIG. 1.—PEDESTAL OF MUSIC-STAND.

(2.) This is a piece $\frac{5}{8}$ inch thick, and 5 or 6 inches long from *centre* to *each* of the three screw-holes shown (Fig. 3) at angles, according to the length of foot adopted. Its edge is bevelled. Plan it with pencil, and bore the holes and cut mortises before sawing out the piece, as shown in Fig. 3 (plan), and 2 (section).


FIG. 4.—COLLAR.


FIG. 7.—DESK—SIDE VIEW.

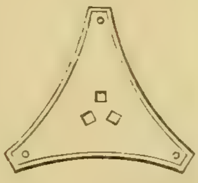


FIG. 3.—FOOT-PLATE.


FIG. 5.—CAP.

(3.) The *feet* (Fig. 2) are cut out of $\frac{1}{2}$ or $\frac{5}{8}$ inch stuff with a fret-saw, with a length, over all, of $7\frac{1}{2}$ to $8\frac{1}{2}$ inches. A little carving adds to the lightness and grace of their appearance. The feet must be of *exactly equal* dimensions, and when placed together the points for the screws to *post* and *foot-plate* must be marked so as to secure uniformity. The same care must be exercised in boring the screw-holes in the posts where the upper scroll of the foot is attached, or the column made of the three will not stand upright.

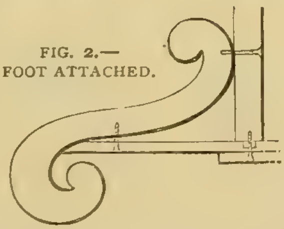


FIG. 2.—FOOT ATTACHED.

(4.) The *collar* is made of $\frac{5}{8}$ inch stuff, mortised as in Fig. 4, so that the upper ends of the $\frac{3}{4}$ inch square posts may fit them closely, leaving a triangular aperture at their backs, which will easily admit a $\frac{3}{8}$ inch brass rod. The mortises must be cut before the *collar* is cut out of the stuff and shaped. Fitting it in place, with a $\frac{1}{4}$ inch Jenning's bit bore a hole through the edge of collar and post to take the thumb-screw, whose plates are to be fastened; one (the female), *inside* the *post*, and the other (loose) on the outside of *collar*. I used the contrivance made for cabinet-makers to secure looking-glasses to their posts (on chests of drawers), having to file off a part of the screw shank, and round it carefully, so that its extremity would not disfigure the brass rod.

(5.) The *cap*, made of $\frac{3}{8}$ inch stuff (Fig. 5), of exactly the same shape as the *collar*, but having a hole (to fit the rod loosely) in place of the mortises, and in its exact centre. It is screwed down to the *collar* and ends of posts after all the parts have been finally fitted.

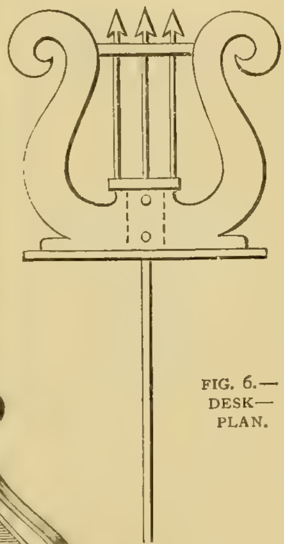


FIG. 6.—DESK—PLAN.

(6.) The *rod-piece* is cut out of $\frac{3}{4}$ by $1\frac{1}{4}$ inch stuff, bevelled on the flat to hold the *desk* at a proper angle, and bored to receive the upper end of brass rod *tightly*, say for $1\frac{1}{2}$ inch deep. The boring should be done and rod be fitted before shaping this piece.

(7.) The *desk* is best made of "3 ply" mahogany, say 18 inches square, more or less, to suit ideas of maker. Mine, which is shown in Figs. 6 and 7, measures 13 inches high by 18 inches wide, having a music rest 1 inch wide, with elevated edge to prevent music slipping.

The several parts should be finished with glass paper finely, and French-polished before being fitted together. I have found a wonderful labour-saving contrivance for the polishing part of the operation in Henry Flack's *Amateur's French Polish*, or if the work is to be ebonised, his Amateur's *Ebonite French Polish* is yet more surprising in its effects. Mr. Flack's factory is at 75, *Blackman Street*, *Southwark.*

When ready to fit the several parts first screw each foot to its own post (Fig. 2), being careful that the screw passes in exact right angle to post; then

slip the foot of latter into its mortise in foot-plate and screw the corners of the latter to the under part of foot; then perforate a small triangular piece of ½ inch wood with screw holes exactly over the foot of each post, and with fine 1½ inch screws draw the post closely down upon the foot-plate (Fig. 2). Adjust *collar* and thumbscrew, and if the posts stand then perfectly upright fasten on the *cap*. The rod, 2½ feet long, will then be easily adjusted at any required height by the pressure of the screw. The feet may be bored, and the holes filled with melted lead, if it be desired to lower the centre of gravity. The wood, if mahogany, will cost less than 2s.; the "3 ply" (for desk) 2s. 9d., the rod 10d., the thumb-screw 6d., and the "Amateur French Polish" 1s. 6d., making the whole amount, say 7s. 7d.

BEE-HIVES AND BEE-FURNITURE.

By WALTER J. STANFORD.

II.—Broad-Shouldered Frame—Staple-end Frame—Pine's Metal Ends—Pigott's Combined Frame, Block, and Trough—Dummies—Supers—Raynor's Super—Baldwin's Super—Sections.

HAVING got a sound and workable hive, we must now proceed to furnish it; and as I think the frames are the most important item, I will begin with them. As I have already stated, the shape and dimensions have been fixed for these frames by the British Bee-keepers' Association, but the Association did not fix a length for the top bar nor a standard plan for keeping them the right distance apart; 17 inches is generally accepted as the best length for the top bars, but many and various devices have been planned for keeping the right distance, each of which has its merits. Messrs. Abbott Bros., of *Southall*, invented the broad-shouldered frames, and all their hives are fitted with them.

The projecting shoulders insure accuracy in the distance, and give steadiness to the frames, but their great disadvantage is, that it is impossible to manipulate without crushing bees under the shoulders. Besides this, bees which are accidentally left outside in the trough must stay there, as the shoulders form an absolute barrier to their creeping in again. It is an essential thing to guard against having any space, whether in the brood nest or supers, into which bees can get while the hive is open for manipulating, but can't get out again when it is closed. Another method is to keep the frames apart by a screw, nail, or staple, and of these the staple is preferable, on account of all its corners being rounded off, and thus lessening the chance of its tearing the comb next to it when a frame is taken out or put back again.

Fig. 14 shows a plan of the broad-shouldered and staple-end frames, while Fig. 15 shows a staple-end frame completely finished, with saw-cut for foundation. Fig. 16 is a full size drawing of another dodge, invented, I believe, by a Dr. Pine, and known as "Dr. Pine's Metal Removable Ends." Of these, as they originally stood (Fig. 16) several improvements have been made, notably one by F. Lyon, 94, *Harleyford Road*, *London*, which he has patented: these are superior to the original design, because they can be fitted on without the top bar being cut. Metal, in the first place, should be avoided in a hive as much as possible, as a conductor of heat and cold; and, secondly, they cost 7s. a gross, adding considerably to the cost of furnishing. I therefore strongly recommend sticking to the staple end pattern. Baldwin says, with regard to the wide-shouldered and metal-end frames :—

"The wide-shouldered frames have one advantage. They are easily adapted to roughly-made and temporary hives, which do not require the same amount of skill and workmanship in the making as those intended for stapled frames, but wide shoulders, and those with metal ends, are often found to be so firmly fixed, either by propolizing or swelling, that much force, and even leverage applied by a strong screw-driver is needed to release them. All this jarring and disturbing not only makes the bees very unpleasantly angry, but leads to loss of life."

This, from the expert-in-chief to the British Bee-keepers' Association, is, in my opinion, conclusive. Frame-making doesn't pay unless you possess a circular saw, but for the benefit of those who do not possess one, and cannot afford the big prices charged for them, Messrs. Booth, of *Dublin*, have constructed a saw of great power and small cost, a description of which will, I hope, soon appear in Amateur Work. Having a circular saw, make your own frames. The price generally charged for frames in the flat, *i.e.*, not nailed together, is 20s. per gross, while you can make them for 10s. a gross, and once the wood is sawn the rest is easy and simple. I generally count half a gross a good day's work. They should be made out of good seasoned yellow pine. You will want for every gross of frames: five, 12 feet 9 inches by ½ inch, first pine; two, 12 feet 9 inches by ¼ inch, first white deal. It will be very easy to calculate for small quantities by following my directions for making them.

Out of a ½ inch board cut eight pieces 17 inches long, and plane them up to stand 17 inches exactly when finished. If you set the circular saw for a cut 1 inch wide, exactly, out of each of these eight pieces

eight top bars will be got, or sixty-four in all; and similarly out of another $\frac{1}{2}$ inch board you can get 144 pieces exactly $7\frac{7}{8}$ inches long, or sufficient side pieces for 72 frames, and the $\frac{1}{4}$ inch board will give 80 bottom bars 14 inches long, exactly. Cut out sufficient wood for the number of frames you want, and when they are all sawn up, they must be planed to the same thickness and width. When this is done, run a saw cut about $12\frac{1}{2}$ inches long down the centre of each top bar. This is to fix foundation in. The ends of the top bars are then cut to a V shape to lessen the chance of the bees propolizing them to the hive sides. A little mould is easily made for doing this, by cutting a short piece of hard wood to the required size and shape, and nailing another piece at right angles to one side, so as to form a guide to keep the point of the V exactly in the centre of the bar, Fig. 29.

The pieces can now be nailed together as Fig. 15. To facilitate the nailing together and the planing of the pieces to the right width and thickness, Mr. Pigott, of *Leixlip, Co. Dublin*, devised the combined Frame, Block and Trough, Figs. 17 and 18, which he has kindly given me leave to describe in this paper. Fig. 17 shows the front of it, or the side used for nailing the frames together; Fig. 18 shows the trough at the back.

To construct it procure a piece of red deal 18 inches by 10 inches by $\frac{7}{8}$ inch; plane and square it up. Call the flat sides "upper" and "lower," and the long edges "top" and "bottom." Find the exact centre of the "top" and square a line across 7 inches away on either side, so as to have a 14 inch space in the centre. Now procure two pieces of hard wood $9\frac{1}{2}$ inches by $1\frac{1}{4}$ inches by 1 inch, and let these two into the "upper" side (see Fig. 17) and screw them in firmly from the "lower" side. Their ends can be just seen, Fig. 18. When glued and screwed in, they should be exactly 14 inches apart inside. Another piece of hard wood, 14 inches by $1\frac{1}{2}$ inches by $\frac{7}{8}$ inch, is screwed and glued on $\frac{5}{8}$ inch away from the "bottom" edge of the "upper" side, so as to leave $8\frac{1}{2}$ inches exactly between *its* top edge and the "top" edge of the whole. These three pieces must be very accurately squared and fitted, as on them depends the accuracy of the frame.

Next cut out and square up two pieces of red deal $6\frac{1}{2}$ inches by $7\frac{5}{8}$ inches by $\frac{7}{8}$ inch. On each of these cut 3 slots $\frac{7}{8}$ inch by $\frac{3}{16}$ inch, A, A, A, Fig. 17, and sink for a screw-head and washer, $1\frac{1}{2}$ inches by $\frac{3}{4}$ inch by $\frac{1}{4}$ inch round each of them. The screws for these must be $1\frac{1}{2}$ inches long, with flat faces, to sit on washers. These two separate pieces will thus have room to move backwards or forwards on the screws, and can be tightened into any required position by a wedge, Fig. 19, fitting into a hole cut for it in Fig. 17, which, of course, must go right through. In cutting this hole, B, Fig. 17, be careful to take a little less out of the sliding pieces than out of the fixed one, or the wedge will not be able to act. Two gaps, $\frac{1}{2}$ inch wide, must be cut out of the two vertical let-in pieces, as shown in Fig. 17. This is to allow the extra length of the top bar to pass through while nailing on the bottom bar as will be seen directly. A piece of red deal $18\frac{1}{2}$ inches by 2 inches by $\frac{5}{8}$ inch is fitted on level with the "bottom" edge of the hole and nailed to the bottom of the horizontal piece of hard wood.

Next prepare two feet for the whole to stand on, out of $\frac{3}{4}$ inch stuff, and $2\frac{1}{2}$ inches wide; one of them $6\frac{1}{2}$ inches, and the other $4\frac{3}{4}$ inches long. It is necessary to have one of them a little shorter, to prevent it catching your hand when planing on the Fig. 18 side. Figs. 17 and 18 show how these are cut and nailed on.

To lessen the risk of the whole warping, two pieces are nailed across the grain at each end. Cut out and nail on to the "top" at one end, $8\frac{1}{2}$ inches away from the original centre, a little piece about $1\frac{1}{2}$ inches by $1\frac{1}{2}$ inches by $\frac{1}{2}$ inch, so that the 17 inch top bar will be kept by it exactly in the centre.

To nail a frame together, put the bottom bar and sides in their places, and tighten in the sides by the central wedge. Lay on the top bar, and drive two nails into each side-piece. Loosen the wedge, turn the frame upside down, and nail on the bottom bar.

The trough part is very simple. Plane up two pieces of red deal 20 inches by $1\frac{5}{8}$ inches by $\frac{3}{4}$ inch, and screw and glue them on in the centre; the distance between them should be just more than the width of the wood part of your largest plane. Gauge up accurately two pieces 20 inches by $\frac{5}{8}$ inch by $\frac{7}{8}$ inch, and also two pieces 20 inches by $\frac{1}{2}$ inch by $\frac{5}{8}$ inch. At one end of your trough screw on $\frac{1}{4}$ inch thick wooden stop, leaving a $\frac{1}{2}$ inch space between its ends and the pieces already screwed on. When you want to plane up the $\frac{7}{8}$ inch width for the frame pieces, tack the two $\frac{5}{8}$ inch hard wood slips inside the trough. Your plane will run on these, and by filling the trough with the roughly-sawn strips, you can gauge all very easily to the exact width; similarly for the $\frac{5}{8}$ inch thickness. These slips should be screwed in in preference to nailing them, as they have to come in and out continually. It will make a much better job if you glue as well as nail the frames together. I always do, and never have a broken or twisted frame. Fine moulders' brads, 1 inch and $1\frac{1}{2}$ inches, are the best to use.

To complete the frame, a little saw-cut must be made, as shown Fig. 15, at one end, into the long central saw-cut, to allow half of the top bar to

be opened to put in the foundation. Two small screws hold it in its place afterwards, see Fig. 15. To fix the foundation in the saw-cut, take the sheet, and with the front of an ordinary chisel slightly wet, flatten the cells all along one long edge on both sides. Drive a nail into a board, take a frame upside down, and put the nail head into the long central saw-cut, take the sheet of foundation between the thumb and first finger of each hand, and hold it inside the frame over the saw-cut, pull the slit open against the nail and slip in the foundation. It can then be screwed up. To keep the foundation exactly in the centre at the bottom, get the finest copper wire possible, and about 2 inches from the bottom of the frame bore two small holes, one above and a little to one side of the other, through the centre of each side; the wire can be passed through the lower hole at each end, and returned through the upper holes on the other side of the sheet of foundation, and the two ends twisted together by pliers.

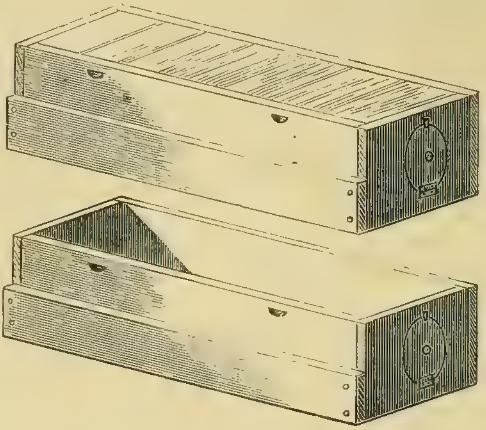


FIG. 24.—RAYNOR'S DIVISIONAL RACK.

The staple pattern frames are kept the right distance apart by means of small bell staples driven in, the two ends of the staple being first pinched together so as only to make one hole in the top bar. To gauge the exact depth for each staple, get a huge old iron staple, and cut off one of its legs so as to leave the hook and the other leg complete, drive the remaining leg into any strong, flat, waste piece of wood, till the distance between the inside of the hook and the wood nearly equals 1½ inch, Fig. 39. Holes must be bored for them with a fine bradawl in the top bars to avoid all risk of splitting. The staple is then driven in till frame and staple will just pass under the gauge. Each frame takes two staples, one at one end, and the second on the other side at the other end; and in making frames care must be taken to put the staples in similar places in every frame. I always put a staple in the right hand bottom corner of a frame, and then turn the bottom end to the top and do likewise. I have now completed frame-making, but before I leave the subject, I should like to say a few words on what are call reversible frames, or frames which can be turned upside down. I cannot do better than extract from Mr. Alfred Neighbour's remarks in the "Bee Journal," Feb. 1st, 1885:—

"When a frame of comb is reversed, the honey cells are at the bottom, and the brood is now uppermost. The bees will not suffer their stores to be placed in such an unsafe position, and will begin to empty the cells. In doing this, the queen is stimulated in her vocation, for she will have increased space when the cells are cleaned out, and the honey carried up into the supers. Thus the whole space within the frames becomes devoted to brood, and the hive being strong in numbers, is ready to take advantage of a favourable opportunity for honey gathering, the produce of which they will deposit in the supers. Another advantage is likely to follow, and that is, that the reversed combs will be built up to the bottom bar, and thus a firm slab of comb will be formed."

That is the promoter's side of the question; and certainly in many instances experiments have succeeded, but to me it seems against nature, and the Editor of the "Bee Journal," Mr. Cowan certainly is not favourable to them at present. In the Journal for December 1, 1885, the Editor gives the history and four different methods of reversing, while, in the issue for December 15, in comparing the advantages and disadvantages of the system, he says:—

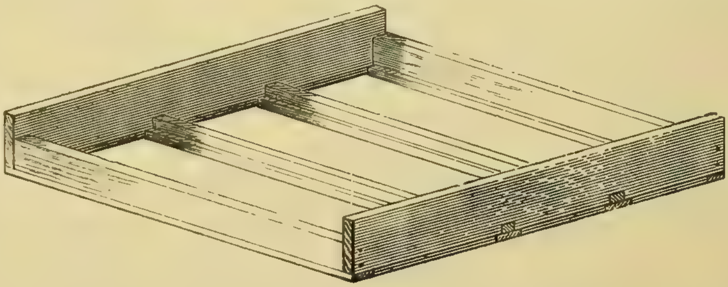


FIG. 25.—OPEN-SIDED RACK.

"Our object should be to have hives as simple as possible, and to do with as few complicated appliances as we can; and notwithstanding the statements of Mr. Heddon" (an eminent American apiarist) "and others, we confess we do not yet see the enormous

FIG. 27.—SECTION IN THE FLAT.

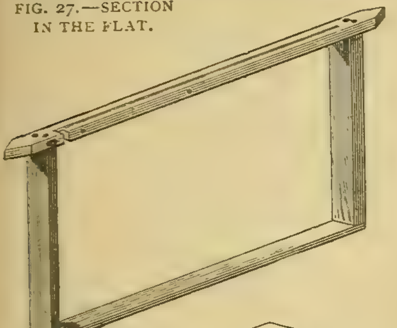


FIG. 15.—STAPLE-END FRAME, COMPLETE.

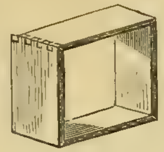


FIG. 28.—SECTION FOLDED.

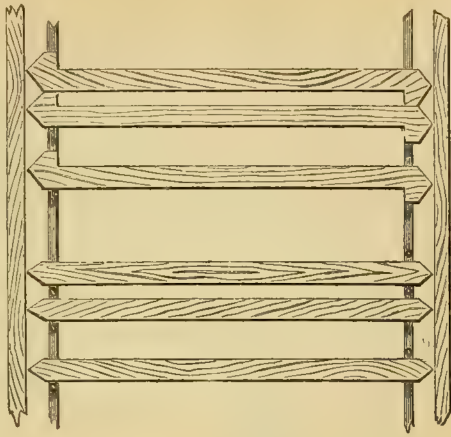


FIG. 14.—PLAN OF "BROAD-SHOULDERED" AND "STAPLE-END" FRAMES.

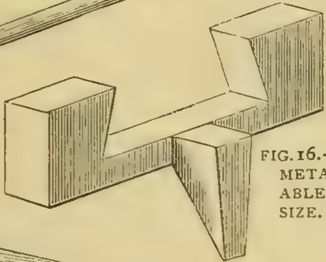


FIG. 16.—DR. PINE'S METAL REMOVABLE END—FULL SIZE.

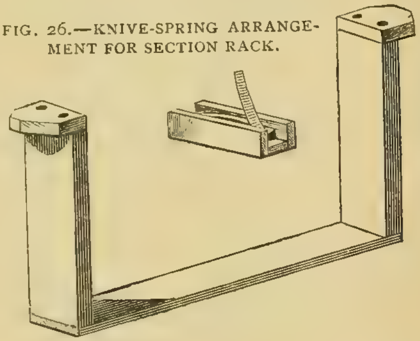


FIG. 26.—KNIVE-SPRING ARRANGEMENT FOR SECTION RACK.

FIG. 21.—BROOD NEST SECTION RACK.

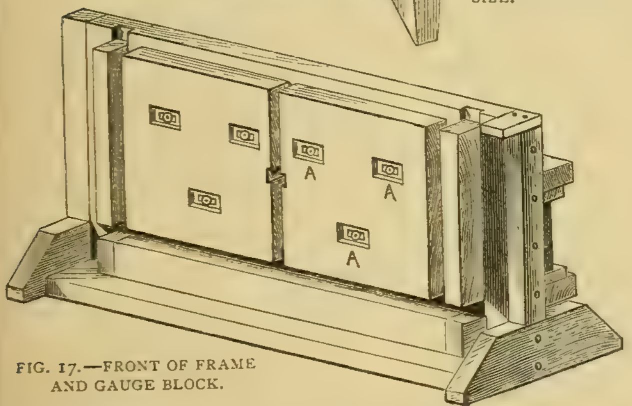


FIG. 17.—FRONT OF FRAME AND GAUGE BLOCK.

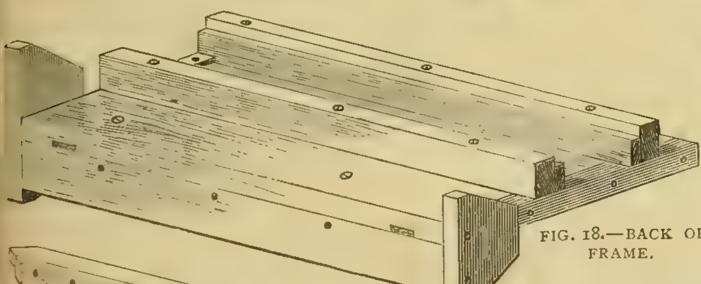


FIG. 18.—BACK OF FRAME.

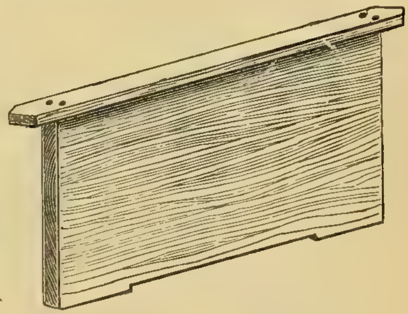


FIG. 20.—A DUMMY.

FIG. 29.—MODE OF CUTTING V ENDS TO FRAME TOP BARS.

FIG. 22.—PLAN OF SUPPORT FOR BROOD NEST SECTION RACK.

FIG. 19.—WEDGE FOR FRAME.

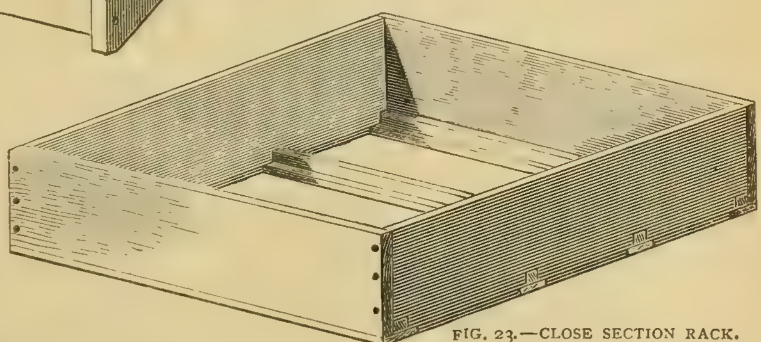


FIG. 23.—CLOSE SECTION RACK.

advantages to be derived from adding to the complication of our hives by adopting the principle of reversible frames. We are also supported in our views by the fact that the reversible frame has not come into general use in America. Practical bee-keepers do not use it, and we may be sure that if reversing frames were of such great advantage, they would not be long in adopting them," etc., etc. After that, my advice is that of "Punch" to people about to marry—"*Don't*"!!

We next come to dummies. These are plain bits of board, fitting exactly inside the brood nest, with an ordinary top bar (minus the saw-cut), nailed on, and are used for contracting the brood nest to any desired sized. You will want two of these, a back and a front one. The front one should be of 1 in. stuff, while ½ inch will be sufficient for the back one. To prevent their warping, it is advisable to nail, or tongue and groove on pieces across the grain at the ends, on the drawing board principle, see Fig. 20. A space of about 8 inches by ¼ inch must be left at the bottom of the front dummy for the bees to pass under. A similar space need not be left in the back dummy.

It is often hard to get bees to begin work in the supers, but if sections are first placed in the brood nest the bees take to them very willingly. When once started, they can be removed to the supers, bees and all. We next want, then, some sort of rack to hold the sections in the brood nest. Fig. 21 shows such a rack. The bottom bar is 14 inches by 2 inches by ⅛ inch. Side-pieces, 8 inches by 2 inches by ⅜ inch, and Fig. 22 shows a plan with dimensions for supports for it, made of ½ inch stuff, though the exact shape is really unimportant. To complete the fittings of the brood nest, a queen excluder is necessary, but I will describe that in my paper on the metal work.

We next come to supers. The super section racks are generally made to hold twenty-one sections, though there is no reason why they should not hold a few more, but as twenty-one is the accepted size, I make most of mine to hold that number. They are made on two main principles: first, where all the twenty-one sections are fitted into one rack; and, second, where three separate racks holding seven each are made. Every apiary should allow at least one of each kind to every stock; because in the glut of the season one stock takes at least forty-two sections to keep it going, while at the end of the season it is necessary to reduce to seven or so, putting in half completed sections to be finished if possible. Fig. 23 shows the single principle, while Fig. 24 shows two of the divided principle, one of them full and the other empty. The idea of dividing them originated with the Rev. George Raynor, and is hence called by his name; the special pattern (Fig. 24) is Baldwin's Improved Raynor Divisional Super. Fig. 25 shows another pattern very much used, though I do not use them myself, as I think them too cold for the bees, but they save timber immensely, and are easily made.

To make Fig. 23, nail up an ordinary box of ½ inch planed stuff 15¾ inches by 14¾ inches by 4½ inches, inside dimensions. Cut four laths ½ inch square, and equal to the longest side of your box, and let them into the short sides, as shown by their ends in front (Fig. 23) so as to leave exactly 4¼ inches between the insides of each. Cut two ¼ inch strips 1¼ inch wide, and nail them over the two central laths from underneath. The sections will sit on these. Cut two pieces 16½ inches by 1 inch by ¼ inch, and nail them along the two sides from the bottom, allowing a little projection (about 3/16 inch) into the rack, and in front and behind nail two other pieces flush with the inside and outside. Now cut another piece equal in every respect to one of the short sides of the rack; this will fit inside, and will require four little bits taken out of it to fit the projections inside. This keeps the sections together by means of a wedge or a knive-spring arrangement (Fig. 26) between it and one of the rack walls. It can now be filled with sections. The knive-springs can be bought from all hive-makers for 1s. a dozen, and the little troughs are easily ploughed out. They are about ½ inch wide, and ⅜ inch deep, and 2 or 3 inches long, and by driving a nail into the trough and catching the hoop of the spring, the two are easily fixed together.

The Raynor principle (Fig. 24) is made of ½ inch planed stuff; inside dimensions, 14¾ inches by 4⅝ inches by 4⅝ inches. One side is cut only half the width of the other three, before nailing it up. A separate piece 14¾ inches by 4⅝ inches by ⅜ inch jams in between the low side and the sections, and keeps the sections in place, thus dispensing with the knive-spring, but a little space at one end must be left to give room for manipulating. A narrow lath can be tacked in underneath to both long sides as a support for the sections. The open rack (Fig. 25) is so similar to Fig. 23 that I needn't go into details The inside dimensions are 14⅜ inches by 13¾ inches. Two sides are 2¼ inches deep and the other two 1⅛ inch.

A few words about sections are necessary. I mentioned the two sizes generally used in my last paper. The racks I have described are all made to hold the one pound, 4¼ inches square size. Two pound (and other) sizes would, of course, only require different dimensions. Sections are generally made out of an American white wood ⅛ inch thick, and are made all in one piece with three corners, V grooved, for holding them into their box-shape while the fourth is dovetailed (with straight tails).

Fig. 27 shows a section in the flat as it is bought,

Fig. 28 shows a folded section as given to the bees. The top and bottom pieces of the folded section have cuts in them of such a size that when two are placed together with a "divider" between, there is just room for a worker bee to pass up, but a queen is supposed to be too big. It is very necessary to prevent her majesty from ascending, if possible, to lay in the supers, which she does sometimes, as a section with brood in it is quite spoilt. Some people use sheets of queen excluder zinc, but the bees don't like it, as it bothers them, having to squeeze themselves through when they are rushing to unload, and start again in the full swing of harvest. I take chances and don't even tighten the sections together too much for similar reasons, and have only had a few sections spoilt altogether. Give the queen plenty of room below, and she very seldom will try to go up. It certainly does not pay to make one's own sections. Baldwin charges 28s. per thousand, but they are to be had for 24s., quite as good from other leading importers, or less than 2s. 6d. a hundred. In folding sections the corners should first be dipped in warm water to avoid breaking them by the bending action.

(*To be continued.*)

REPOUSSÉ, OR RAISED METAL WORK.

By H. C. STANDAGE,

Author of the "Artists' Manual of Pigments," etc., etc.

V.—SOLID AND HOLLOW BLOWS.

IT is a commonly received notion that repoussé consists solely of punching a design by means of punches and a hammer, no notion being conceived of the various kinds of blows needed to be given for obtaining success. It is due to such erroneous notions that amateur's repoussé work is so crude, and scarcely repays, artistically considered, the tyro. Since the chief success consists of how to adapt the blow to be given to the nature of the work required, we go minutely into details of the two most distinct kinds of blows.

One kind of blow to be given by the hammer on the metal—not with the punch at all—is what is technically called *opposed* or *solid* blows. These have the effect of stretching or thinning the metal, and the other kind of blows are technically called *unopposed* or *hollow* blows. These blows have less effect in thinning than in bending the metal; in fact, the metal often becomes thickened by hollow blows.

Figs. 16, 17, and 18 illustrate these various blows. In Fig. 16 the hammer is directly opposed to the face of the anvil, and meets it face to face, and would be said to give a solid blow, one which would not jar the hand grasping the plate, were the metal ever so thick or rigid, and this blow would thin the metal by its sudden compression between the two hard surfaces, the face of the hammer being represented at A. If a piece of sheet metal be struck by blows of this kind, its face—or sides struck by the hammer—will present a surface of indentations, or a small portion of a hemispherical curve, and the thinning process consists in beating down the ridges formed by the circumference of these circular indentations; and this is accomplished by starting from one indentation and then going round its circumference by a series of blows that partly overlap this starting point, and also overlap each other. In most cases, blows of this kind, while thinning the metal, also harden it, or make it brittle, which will render the metal liable to crack; therefore, frequent annealing is required where the metal has to be beaten very much or very thin. If a flat-faced instead of a rounded-faced hammer were used, the sheet of metal would eventually tend to cockle up at the corners.

The hammer in Fig. 17 is not directly opposed to the anvil, or rather to that point of it which sustains the work, consequently, this would be called a hollow blow, one which would jar the hand were the plate thin and rigid, and it would bend the plate partly to the form of the supporting edge. This bending of the metal would not arise from a quiet pressure employed, but by impact, or by driving blows. The hand situated at A, Fig. 17, would be insufficient to withstand the blows of the hammer at C, but for the great distance of A B, compared with B C, and the thin, flexible nature of the material. For these reasons the coppersmiths and others never require tongs for holding the metals the same as the blacksmith, except at the fire, as in annealing and soldering. In hammering thin works, a constant change of position is required, and which can be in no way so readily accomplished in the exquisite mechanism given us by nature—the unassisted hand. When, however, the works are too rigid or too small to be thus held, the anvil is made to supply the two points A, C, as in Fig. 18, and the blows of the hammer directed between them.

The raising of the metal in repoussé is chiefly accomplished by blows given to punches, instead of striking the metal direct with the hammer, this is necessarily so in very intricate patterns, and fine work, but this does not preclude the above kinds of blows being given—in fact, the face of the punch should be looked upon as the representation of the hammer's face, regard being had to the position of the punch and metal; thus, for solid blows, hold the

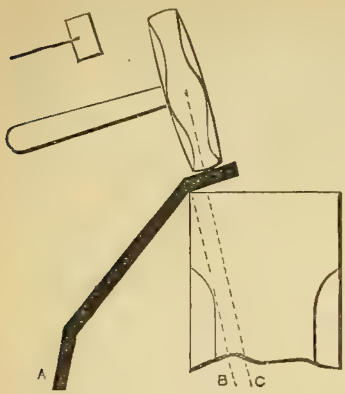


FIG. 17.—PARTLY OPPOSED BLOW.

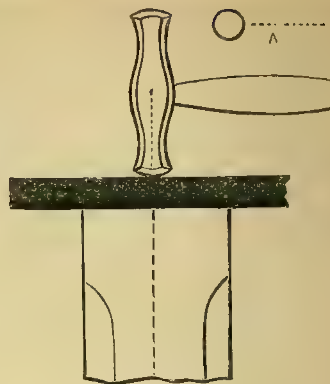


FIG. 16.—OPPOSED OR SOLID BLOW.

punch close on to the metal, and then strike the punch with the hammer. It is not the weight of the hammer, but the quickness of the blow that tells; the blow should be a short, quick, sharp tap, and the punch removed to the next spot before repeating the blow. By holding the punch close to the metal the latter will be thinned, but still remain flat. If, however, the punch be held slightly above the surface of the metal, the metal will be indented and pushed out on the other side.

The effects of these blows will be better understood by illustrating them and tracing the effects of *solid* and *hollow* blows given partially on a disc of metal, A A, Fig. 19—supposed to be 12 inches in diameter—first, within a central circle, C C, of 3 inches diameter, and then around the margin A B to the width of 3 inches, leaving the other portions untouched in each case; the thickness of the metal is greatly exaggerated to facilitate the explanation.

First, referring to Fig. 19, the *solid* blows within the circle, C C, would thin and stretch that part of the metal, and make it of greater superficial extent, but the broad band of metal, A C, would prevent it expanding beyond its original diameter, and, therefore, the blows would make a central concavity, as in a cymbal, or, like Fig. 20, and the more blows that were given, either inside the bulge upon a flat anvil, or outside the bulge upon an anvil or head of a globular form, the more would the metal be raised, from its being thinned and extended, and then it might be thrown into the shape of a lofty cone or sugar-loaf, as indicated

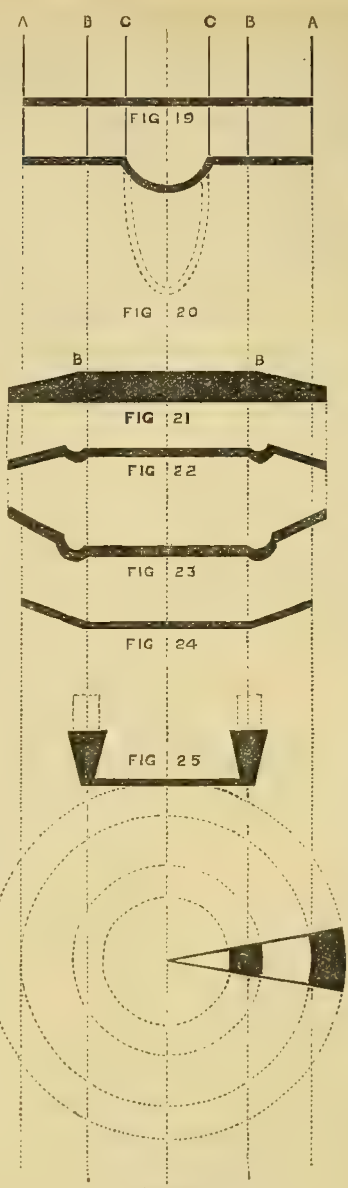


FIG. 26.

FIGS. 19—26. — DIAGRAMS ILLUSTRATING EFFECTS OF SOLID AND HOLLOW BLOWS. FIG. 19.—METAL BEFORE IT IS BEATEN. FIG. 20.—EFFECT OF SOLID AND HOLLOW BLOWS ON CENTRE. FIG. 21.—EFFECT OF SOLID BLOWS ROUND MARGIN. FIG. 22.—GUTTER FORMED BY THINNING EDGE BEYOND DUE AMOUNT. FIG. 23.—CONED FIGURE PRODUCED BY EXPANSION OF INNER EDGE OF MARGINAL RING. FIG. 24.—SAUCER-SHAPE FORMED BY HOLLOW BLOWS ROUND EDGE. FIG. 25.—CYLINDRICAL FORM RESULTING FROM HOLLOW BLOWS ROUND EDGE. FIG. 26—COMPRESSION OF METAL BY HAMMERING SHOWN IN PLAN.

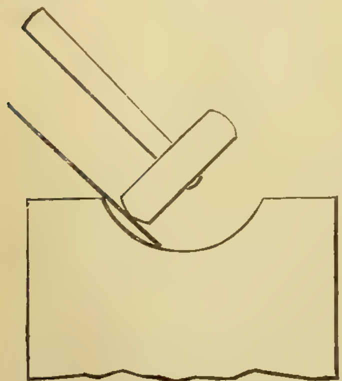


FIG. 27.—FIRST STAGE OF MAKING COPPER BALL.

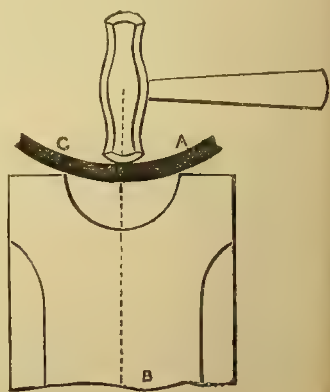


FIG. 18.—UNOPPOSED BLOW.

by the dotted lines. The *hollow* blows given within the same limited circle would also stretch the metal, and drive it with the hollow tools employed, thus producing the same effect as in Fig. 19, but by stretching the metal as we should the parchment of a drum by the pressure of the hand in the centre, or by a blow of a drumstick. Now observe the effect of applying the *solid* blows around the 3 inch margin. These would thin the metal, and cause it to increase externally in diameter, but the plate would only continue flat, as in Fig. 21, if every part of the ring were stretched proportionately to its increased distances from its first position. Were the inner edge towards B thinned beyond its due amount, its expansion, if resisted by the strength of the outer ring, A, would throw back part of the work into a curve, and depress the metal, not as in the cymbal, but in the form of a gutter, as in Fig. 22. It would, however, more probably happen that the inner edge alone of the marginal ring would be expanded, leaving the outer edge undisturbed, and producing the coned figure, Fig. 23.

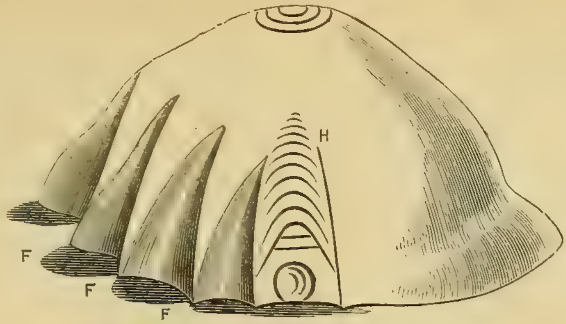


FIG. 29.—REMOVAL OF FLUTES OR PUCKERS IN COPPER BALL.

Now, the *hollow* blows given around the edge would have the effect of curling up or raising the edge, first as a saucer, Fig. 24, and then into a cylindrical form, Fig. 25, provided that by the skilful management of the hammering the metal could be made to slide upon itself without puckering, so as to contract the original boundary circle of the disc, or 12 inches, into 6 inches, or the measure of the edge of the cylinder resulting from the drawing in of the 3 inch margin. In this process the metal would become proportionately thickened at the upper edge, because each little piece of the great circle, Fig. 26, when compressed into a circle of half the diameter, would only occupy half its original length, as it could not be altogether lost; and the metal would therefore increase in thickness in a proportional degree. The remainder of the circle serves for the time as effectually to compress the metal as if the radii were the sides of an unyielding groove, dotted in Fig. 26. This contraction produces, in fact, the same effect as the jumping or *upsetting* of endlong blows in smith's work. Theoretically the

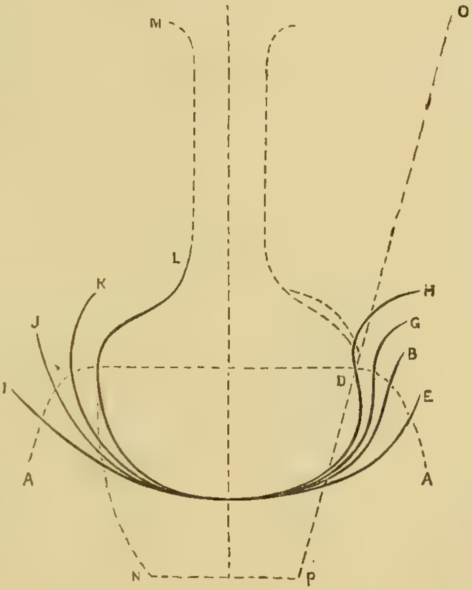


FIG. 32.—TRANSITION OF SWEEPS IN HAMMERING METAL.

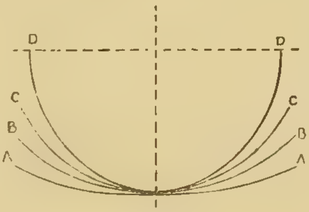


FIG. 28.—DIAGRAM ILLUSTRATING PROCESS OF MAKING COPPER BALL.

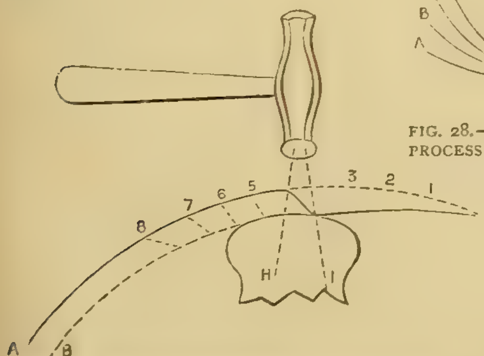


FIG. 31.—TRANSITION FROM SWEEP A TO SWEEP B.

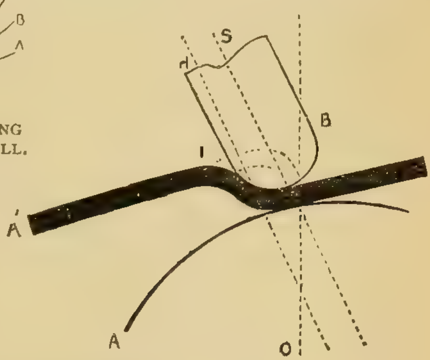


FIG. 30.—BLOW PARTLY SOLID AND PARTLY HOLLOW.

thickness of the upper edge of the cylinder would be doubled, and the lower edge would retain its original thickness, as in Fig. 25; whereas in extending the margin of the disc by *solid* blows, as in Fig. 21, the thinned edge would be found to taper away, also in a straight line, from the full thickness even to a feather edge, if sufficiently continued, but neither of these cases would be admissible, as the general object is to retain a uniform substance.

In equalising the thickness of the cylindrical tube, Fig. 25, the solid blows would thin the metal, but at the same time throw it into a larger circle; it would then require to be again driven inwards, which would again slightly thicken it. So that in reducing the metal to uniformity, two distinct and opposite actions are going on, and upon the due alternation, combination or proportioning of which will entirely depend the ultimate form—that is, whether the metal be allowed to continue as a cylinder, to expand or to contract, either as a cone or as a simple curve, or to serpentine in any arbitrary manner, according as the one or the other action is allowed to predominate.

This subject, says Holtzapffel, from which the above is taken, is too wide to enable anything more to be offered than a few general features, and I shall therefore proceed to trace briefly the practice in some examples. Fig. 27 represents the first stage of making the body of a copper ball. The metal is first driven with a mallet into a concave bed, generally of wood, in which it is hastily gathered up to a sweep of about the third part of a sphere, as A A, Fig. 28, but this puckers the edge like a piece of fluted silk, or the serpentine margin of many shells, in the manner represented at F F F, Fig. 29, which is twice the size of Fig. 28. The next step is to remove the flutes or puckers by means of blows of the raising hammer (*i.e.*, hammer used for repoussé work especially) applied externally, as exhibited by the black lines at H, Fig. 29. In Fig. 30 are represented on a still more enlarged scale the relative positions of the hammer, anvil, and work. Thus, A represents the globular face of the anvil, B the rounded edge of the raising hammer, which, like the pane of an ordinary hammer, stands at right angles to the handle, and A, I shows the work, A being the edge, and I the point of the flute. The blows of the hammer are made to fall nearly on the centre of the anvil, and at a small angle with the perpendicular, the hand being on the side A. A few blows are given as tangents, or directly across the point of the flute, and when it exceeds the width of the hammer, oblique blows are given to restore the pointed character, to be followed by other blows parallel with the first, as shown at H, Fig. 29. These hollow blows cause the sides of a flute to slide into one another, almost as when two packs of cards, placed like the ridge of a house, penetrate into each other and sink down flat in a manner somewhat resembling that by which the original and extreme margin in Fig. 26 becomes by the successive blows contracted to the inner circle, but in the present case the plait slides down to the general curve of the spherical dish.

If, however, the puckers of a large globe were entirely removed by hollow blows, the central lines of the flute would become thickened, and therefore solid blows are mingled with them, or rather the one blow partakes of the two natures; thus far the curvature and oblique position of the hammer, Fig. 30; its face is solid at S to that part immediately below it, but towards H it rather bends than thins the metal. The flatter the curves of the two surfaces, the greater the extent of the solid or thinning blows; the plates are not, however, entirely gathered up, as the dish A A, Fig. 28, always opens a little for the metal becoming stretched under the treatment for removing the flutes.

The first essay for the repoussé worker to attempt could not be a better one than the beating of a sheet of metal into a cup or basin-like form, reading over the above details several times while practising, until a knowledge of the above principles are positively acquired; by this method he will become well grounded in the methods of giving a hollow and solid blow.

Throwing the work into flutes, as above described, is not imperative; for the hemisphere might be entirely raised, as in the succeeding step, by blows on the outer surface upon a convex tool or head, but the flutes quicken the process and speedily give a concavity, which is convenient, as it makes the work hang better on the face of the anvil.

The outer curve, A A, Fig. 28, which represents the copper dish when the puckers have been removed, will not be sent into the hemispherical form, or the inner line, D D, at one process, but will progressively assume the curvatures B B, C C, and sometimes many others; neither will the work be changed from the curves, A A, to that of B B at one sweep, but the hammer must necessarily operate by successive blows arranged in circles, the proximity of which circles will at length include within their range the entire sweep, A A or B B, each of which is called a *course*, and before proceeding from one course or sweep to the next, the metal requires to be annealed.

Figs. 31 and 32 explain the transition or conversion from the first sweep A to the second sweep B; the black lines represent the metal after a few circles of blows are given. Fig. 31 shows the narrow edge of the raising hammer in the act of descending upon the centre of the bend or stroke, and as a tangent to the circle. It first throws in a little rim at I, which connects the new and old sweeps by a curve

or ogee, then another little circle, 2, will be similarly gathered in, then 3, 4, 5, and so on up to the edge. Now the artifice consists in making the intervals, both of the great sweeps, A, B, C, Fig. 28, as large as practicable, provided they do not cause the exterior metal to pucker, or become in plaits, as this would endanger it, ultimately cracking at those places, where the metal might have become plaited. In thus raising in the metal, it necessarily becomes thickened from its contraction in diameter; but as in Fig. 30, the hammer at H gives a hollow blow and bends, whilst the part S gives a solid blow and thins, the two effects are thus combined, and when they are duly proportioned, by a hammer more or less round, and blows more or less oblique, the true thickness, as well as the desired change of figure, are best obtained. It is easier to get the hemisphere by a little excess of thinning or by a superfluity of blows; so that the less skilful workman will use a piece of copper of seven inches diameter, with additional blows for a six-inch hemisphere; but the more skilful will take a piece of seven and a half inches diameter and produce the work with less labour. Occasionally, when the work is common and thin, from three to six hemispheres or other pieces are hollowed together, the outer piece is cut as a hexagon or octagon, and its angles are bent over to embrace the inner pieces, before the process of hollowing is begun, and which scarcely consumes more time than for one only. This is a general practice in hollowing tin works, such as the covers of saucepans, as the number of thicknesses divide the strength of the blows. The several pieces are then twisted round at intervals, so as to arrange them in a different order, which mixes the little imperfections, and tends to their mutual correction. The raising process represented in Fig. 26 is also performed upon two or three pieces at a time when they are sufficiently thin to permit it.

My readers will pardon me mentioning the interesting fact that one of the most conspicuous and remarkable examples of raised work is the ball and cross of St. Paul's Cathedral, London. The old ball consisted of sixteen pieces riveted together; the present ball also 6 ft. diameter and $1\frac{1}{8}$ thick, was raised in two pieces only, and may therefore be considered to mark the improvement in the coppersmiths' art in making large works, such as sugar pans, stills, etc. The metal was first thinned and partly formed under the tilt-hammer at the copper-mills, or sunk in a concave bed; the raising was effected precisely as explained in Fig. 26, and hammers but little larger than usual; the two parts were riveted together in their places, and the joint is concealed by the ornamental band. All the work is modern, and is mostly hammered up, except the cast gun-metal consoles beneath the ball, which formed part of the original metallic edifice, a name to which it is justly entitled, the height being 9 feet, and the weight of copper $3\frac{1}{4}$ tons. The new ball and cross were erected in 1821 by Messrs Kepp, of London. They are strengthened by a most judicious inner framing of copper and wrought-iron bars, stays, bolts, and nuts, extending through the arms and downwards into the building, thus adding about two tons of iron to the load of copper and to the thirty-eight ounces of gold used in its decoration.

(*To be continued.*)

THE MAGIC LANTERN:

HOW TO MAKE IT AND USE IT.

By A PRACTISED HAND.

V.—THE OXY-HYDROGEN LIME-LIGHT—THE BLOW-THROUGH JET—THE MIXED GAS JET—HYDROGEN: HOW PRODUCED—HOW TO USE THE JETS—HINTS ON WORKING WITH THE LIME-LIGHT—THE DISSOLVING TAP—GAS CYLINDERS—THE PHOTOMETER.

IN the oxy-hydrogen lime-light, hydrogen takes the place of spirits of wine. The oxygen is either blown through burning hydrogen, or the two gases are mixed in a small chamber at the end of the jet and impinge upon the lime; the former arrangement requires a "blow-through," or, as it is often called "safety" jet; the latter requires a "mixed gas jet. A blow-through jet is shown in Fig. 40, and a mixed gas jet in Fig. 41. As will be seen, there are in each jet two tubes, one being for the hydrogen and the other for the oxygen; these terminate at the outer end in the two taps, C and D, to which, of course, is attached the india-rubber tubing communicating with the bags. These tubes are soldered to the cross-piece, E, to which is fixed the upright tube with the thumbscrews for fastening the jet to the tray described in the last paper. In the blow-through jet one of these tubes (usually the left-hand one) is turned up as shown in the figure, and terminates in a larger tube cut off at an angle to form a burner. This is for the hydrogen: the other tube is turned back and directed towards the lime-pin. A fine platinum-tipped nozzle is made to screw on to the end, and thus a fine jet of oxygen is blown through the burning hydrogen on to the lime, the proportion of each gas being regulated by the two taps, so as to obtain a pure white light without any visible flame.

In the mixed gas jet the two tubes open into the chamber, F. Here the gases get mixed and pass up

the curved tube, G, at the end of which is a platinum-tipped nozzle similar to that used with the blow-through jet. The mixing chamber is more clearly shown in Fig. 42; F is a small brass casting, bored at one side with the two holes for the tubes, and having on top the cell or chamber into which the two holes open; H is a brass tube made to screw into the upper part of the cell (or soldered on to it) to form a dome; G is a fine bent tube with a screw cap to enable it to be screwed on to the top of the dome piece; K is the nozzle.

The lime-holder is a similar arrangement to the holder before described. It can either be fixed to the tubes as in Fig. 40, or to the burner as in Fig. 41. As the lime requires to be turned much more frequently when working with the mixed gas jet than with either of the others, a clockwork lime-holder was introduced some time ago for turning the lime at a uniform rate. It could be used with any jet, but is not really required with either the oxy-calcium or the blow-through jet. Another way of turning the lime without opening the lantern is to fit a cog-wheel arrangement to the lime-pin, as shown in Fig. 43; A is a cog-wheel fixed to the end of the lime-pin; B is a second cog-wheel fitted to the end of a lever which extends as far as the jet taps, where, by means of a milled bead it can be turned. A spiral spring is sometimes used instead of the cog-wheels, and answers better, as the lime can then be lowered or raised as well as turned. The spring is made of fine steel wire; one end is attached to the lime-pin, and the other to the lever.

Coal gas is generally used instead of pure hydrogen, because of the trouble of making the latter; but as there are still places where coal gas is not easily to be obtained, and as, moreover, pure hydrogen is preferable to carburetted hydrogen for the lime-light, I will now describe how the former may be produced.

Hydrogen Gas, being one of the constituents of water, is easily obtained by decomposing the latter. The apparatus required can easily be made, and the process is both simple and inexpensive.

We want a generator, a purifier, a couple of short lengths of india-rubber tubing, a few pounds of zinc scraps or granulated zinc, and some sulphuric acid (the common sulphuric acid of commerce will do, and is very cheap). A generator that anyone can make is shown in Fig. 44. It is a large, wide-mouthed glass bottle or earthenware jar, with a cork or bung fitting air-tight into the mouth. Into this cork are fitted the two tubes, A and B (glass or lead tubes should be used, not brass tubes, as the latter would be eaten away by the acid); one tube, A, forms an exit for the gas, the other, which reaches to within an inch or two of the bottom of the vessel, is used for pouring in the acid, and should have a small funnel at the upper end. The purifier is similar to the oxygen purifier already described. The india-rubber tubes are for forming the connections between the generator and the purifier, and between the purifier and the bag.

When you are ready to make the gas all you have to do is to put a layer, about an inch deep, of the zinc scraps on the bottom of the generator, fit on the cork, and then pour the sulphuric acid, diluted with about six times its volume of water, down the B tube until the generator is from half to three-parts full. Bubbles will immediately begin to rise from the zinc, but you must not connect your bag with the purifier just at first, because the air in the upper part of the generator as well as in the tubes and purifier must be driven out. It is better to lose a little gas than to get air in with it to your bag; and, of course, before the bag is connected with the purifier, it must be rolled up as before explained, to get rid of any air that may be in it. When the bubbling ceases, the addition of a little sulphuric acid to the liquid in the generator will generally start it again.

A larger apparatus in which the gas can be stored, as in a gasometer, and which will work automatically, that is to say, will generate gas only as long as it is drawn off, can be constructed out of two barrels or large jars arranged as shown in Fig. 45. The zinc scraps are put on a shelf near the bottom of the lower barrel, which, of course, is shut at top, a large bung-hole being provided near the bottom, for putting in the scraps: this hole can be shut with a tight-fitting wooden or cork bung. The tube, A, forms the exit for the gas which is collected in the upper part of this lower barrel. The dilute acid is poured into the upper barrel in the first instance, and descends by the tube, B, into the generator (the lower barrel). The tap, C, being opened, the air will be expelled by the dilute acid which takes its place; the tap is closed as soon as all the air has been driven out, then the gas rising from the zinc, and unable to escape gradually, forces the liquid back into the upper vessel, and remains under pressure in the generator. When so much of the liquid has been forced out of the generator as to leave the zinc exposed, no more gas will be evolved; but as soon as some of the gas is withdrawn, the liquid flowing into the generator again covers the zinc and the action recommences, and continues until the generator is refilled with gas, or the charge exhausted.

When coal gas is used in connection with a blow-through jet it can be taken direct from the main if it is laid on with sufficient pressure. All that is necessary is to remove the burner from the nearest chandelier, and to connect the gas tube with the hydrogen jet tap by means of one of the india-rubber

tubes. You then put a lime on the holder, turn on the gas, and light it. Put the jet into the lantern, and leave the gas burning to warm the lime and dry off any moisture that may have collected on the condenser while you get your oxygen bag ready. About one hundredweight should be put on the pressure boards if you are using a large bag, but less if your bag is a small one. It is always better to have too obtained when the flame is almost "killed" by the oxygen. A little practice will enable you to judge how best to regulate the taps. It is often necessary to manipulate them at different times during the entertainment, so as to keep the light up to its full brilliancy.

In working with the mixed gas jet a very much greater pressure is necessary, and it is essential that

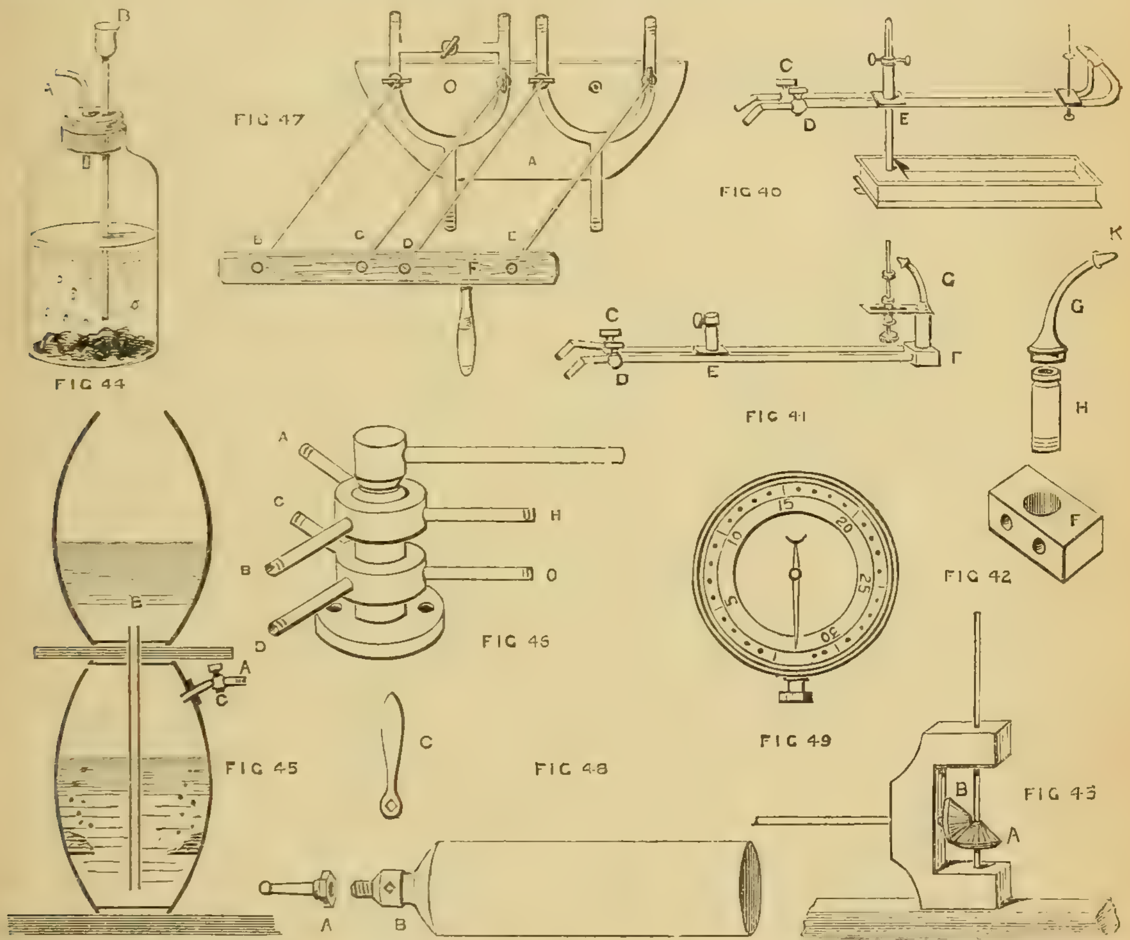


FIG. 40.—"BLOW-THROUGH" JET. FIG. 41.—MIXED GAS JET. FIG. 42.—MIXING CHAMBER. FIG. 43.—MODE OF TURNING LIME WITHOUT OPENING LANTERN. FIG. 44.—SIMPLE GENERATOR. FIG. 45.—APPARATUS FOR STORING GAS. FIG. 46.—DISSOLVING TAP. FIG. 47.—AMATEUR'S DISSOLVER FOR HOME USE. FIG. 48.—GAS CYLINDER. FIG. 49.—PRESSURE GAUGE FOR GAS CYLINDER.

much pressure than too little. If you are working with hydrogen from a bag, the same weight should be put on both pressure-boards, or you use the double pressure-boards, which equalize the pressure exactly. When you are ready to light up, you turn on the oxygen very gradually, and put your lime close to the end of the burner. You will have to manipulate the two taps so as to get exactly the right proportion of each gas. As in the oxy-calcium jet, the best light is the pressure on both bags should be equal. The hydrogen cannot, therefore, be used direct from the main. Iron 56 lbs. weights are the most convenient to use: of these, at least three should be put on each bag at starting. I generally work with four of these weights, and I have often had five on each set of pressure-boards. Of course, the greater the pressure the greater the consumption of gas, and the more particular must you be in seeing that your bags are

sound and that your connections are well made. Indeed, it is often advisable to secure the india-rubber tubes to the taps by binding them round with twine or wire. There is sure to be a slight loss of gas by leakage, so that you must allow for it when filling your bags, and you should not put the weights on to the boards until the last moment. You ought never to put your foot upon the pressure-boards, or allow anyone to sit upon them or in any way interfere with them. This is important at all times, but is doubly so when using the mixed gas jet, with which an accident due to the rushing back of one gas into the bag containing the other would be very likely to occur if the pressure on one bag were thus suddenly increased.

The best place for the bags is in front of the lanterns—not behind. You must, in putting on the weights, make sure that they will not fall off, and, if possible, always use flat weights in preference to round ones. Remember that the oxygen is the last to be turned on and the first to be turned off. Generally more hydrogen is consumed than oxygen, but this is not always the case. Sometimes when using the gases under heavy pressure a hissing noise will be heard ; it can generally be stopped by pinching the oxygen connecting-tube to check the flow of gas for a moment ; if this does not succeed, turn off the oxygen (at the jet tap), and then gradually turn it on again ; if the noise still goes on turn off both gases, and then re-light them. Before using any jet you should make sure that the tubes and the nozzle are clear, and remove any dust that may have got into the connecting-tubes by blowing through them. If the connecting-tubes are too short to reach from the bag to the jet, two or more lengths may be joined by pieces of $\frac{3}{8}$-inch brass piping about three inches long. The ends of the pieces to be connected are sprung on to one of these tubes and secured with twine. In working with the mixed gas jet, some little care is required in regulating the exact proportion of the two gases, and it will often be found that a very slight turn or one or other of the taps will change a bad light into a good one. The proper position of the jet in the lantern must be found out by trial. Lastly, remember that the greater the pressure, supposing it to be the same on both bags, the less chance is there of an accident occurring when using the mixed gas jet. I believe I have now given sufficiently clear directions for the successful working of the different lime-light jets, and will go on to describe what is called

The Dissolving Tap.—This is a tap or combination of taps for producing the dissolving effect when working with the blow-through or the mixed gas jets. The dissolving fan might, of course, be used, but the dissolving tap has this advantage over it, that it effects a great saving in gas. By moving a lever the gases are gradually turned off the jet in the first lantern, and as gradually turned on to the jet in the second lantern. Various forms of this tap have been devised, but the principle is the same in all. Fig. 46 shows one form of dissolving tap. It is, in reality, a six-way tap. The hydrogen and oxygen bags are connected with the tubes or nozzles, H and O respectively. The hydrogen tap of one jet is connected with the tube, A, and that of the other jet with the tube, B ; the oxygen jet taps are connected with the tubes, C and D, the connections being made by means of short lengths of india-rubber tubing. The tap is fixed to the back of the lantern box or stand with thumbscrews. As soon as the connections are made the oxygen jet taps are turned off and the hydrogen ones turned on ; the handle of the dissolver is put mid-way between the tubes, which allows the gas to pass equally to both jets, and the burners are lighted ; then the oxygen is turned on and the light regulated first in one lantern and then in the other. Now if we turn the handle to the left we shall shut off the gases from the left-hand lantern, and turn them full on to the other one ; then, if we turn the handle in the opposite direction, we shall turn them off the right-hand lantern, and full on to the left-hand one. The dissolving may be made as gradual as possible by moving the handle sufficiently slowly. It is evident that it would not do to shut off both gases entirely from the off-lantern as the flame would be extinguished, and we should be under the necessity of re-lighting the off jet each time we wished to dissolve. In the dissolving tap, accordingly, provision is made for the passage of sufficient hydrogen to the off jet to maintain a small flame.

Fig. 47 shows how the amateur may construct a dissolver for his own use. It will not be as neat an arrangement as the dissolving taps sold in the shops, but it will answer his purpose. Two Y pieces, a connecting tube of the same length as the distance between the arms of one of the Y pieces, five taps, four metal rods to form the levers, four screws, and a sliding bar and handle will be required. The two Y pieces are fixed side by side to a metal plate or stand, A, which can be fastened by thumbscrews to the lantern-box. Four of the taps are soldered to the ends of the Y pieces, and to the handles of these taps are fixed the four levers ; the other ends of the levers are made to work on pivots formed by the four screws on the sliding-bar. The taps and levers are so arranged that when the sliding-bar is pushed to the right, the left-hand taps on both arms will be open, and the right-hand taps shut; and when the bar is pushed the other way, the left-hand taps will be shut, and the right-hand ones full open. The fifth tap is soldered

into the connecting-tube, which is then soldered into the two arms of the left-hand Y piece above the taps, so as to allow the hydrogen to pass to the off jet after the gases have been turned on to the other jet. The use of the tap is for regulating the supply of gas to the off jet so that only just sufficient to keep alight may be allowed to pass over.

A dissolving tap of much simpler construction is used in connection with the oxy-calcium jets, as it is only necessary is using them to turn the oxygen on and off each jet alternately. A single Y piece with a tap at the end of each arm connected by levers to a sliding-bar or handle will answer the purpose, but, of course, the other dissolving tap may also be used.

Gas Cylinders are now often used instead of the bags and pressure-boards. They are made of iron, and are filled by means of special apparatus. The advantages of using them are that they take up very little space, that when charged the gas can be kept in them for any length of time, and that they are ready for use at a moment's notice. The chief objection to them is that you must always send them up to London or to one of the large towns to be filled, and when the carriage of them to and fro is added to the price of the gas, it will be found, as a rule, that it is more expensive to use them than the gas bags and boards. However, they are very convenient, and will last long with ordinary care. Fig. 48 shows one: the nozzle, A, screws on to the top, B; a washer, or washers, being used to form a gas-tight joint. The exit is closed by a valve which is opened by means of the lever key, C.

When the cylinder is fully charged the pressure of the gas is so great that the valve must only be opened a very little way. If opened too much or with a jerk the gas will be very likely to blow off the connecting-tube or burst it. In either case the loss of gas would be considerable. The moment you have put out your lights you must close the valve; it is not sufficient to turn off the jet taps, because the gas will continue to force its way out of the cylinder as long as the valve is open. The cylinders are usually made in three sizes, the smallest holds between seven and eight cubic feet of gas, and the largest about double that amount. The largest are the most convenient, because they only require to be refilled half as often as the smallest. As it is very necessary to be able to ascertain from time to time how much gas the cylinders contain, the pressure-gauge, Fig. 49, has been introduced; it is made on the same principle as the steam pressure-gauge; the figures on the dial give the pressure in atmospheres. When the cylinder is "full" the indicator should point to thirty, that is to say, the gas is not compressed in the cylinder to a pressure exceeding thirty atmospheres. A pressure of thirty atmospheres in a large cylinder is equivalent to about fifteen cubic feet of gas. The number of cubic feet is found by dividing the indicated pressure by two in the case of a large cylinder, or by four in the case of a small one: thus, if the indicator points to ten, we should know that we had only five cubic feet of gas in the cylinder, because $10 \div 2 = 5$. If the cylinder was a small one, the same pressure would show that we had only $2\frac{1}{2}$ cubic feet of gas ($10 \div 4 = 2\frac{1}{2}$). This would be the actual amount of gas in the cylinder, but it is not all available for use because a certain quantity will always remain in the cylinder, the pressure being insufficient to force it out.

It is often very useful to be able to estimate the power of your light. This can be easily done.

A Simple Photometer.—This is on the principle of the Rumford photometer, and consists of a paper screen fixed upright at one end of a table. White paper stretched on to a child's small hoop will do very well. A little way in front of the screen you must fix an upright rod; then you get one of the standard candles and place it before the rod and in a line with it, so that a shadow may be thrown upon the screen; then put the light you wish to test beside the candle, so as to throw a second shadow on to the screen on a line with and close to the first. If this second light is more intense than that of the candle it will throw a stronger shadow, and you must move it back from the screen until the two shadows are equal. You then measure the distance of the candle from the screen and square it, and also the distance of the other light from the screen, and square it too, then divide the greater number thus obtained by the lesser, and the quotient is the candle power of the light. The standard candle is a sperm candle of six to the pound, burning at the rate of 120 grains an hour.

(*To be continued.*)

SMITHING AND FORGING.

By GEORGE EDWINSON.

XI.—ORNAMENTAL IRON WORK.

MODERN ornamental iron work differs very much in its characteristics from that of mediæval or of ancient times. Some of the best specimens of old ornamental iron work were forged under the hammer, unaided by such modern appliances as drop presses and swages. The modern methods of producing artistic forms in iron, consist principally of casting molten iron in moulds from patterns, stamping wrought iron with drop presses, cutting with steel saws, chisels, and files, and forging by the aid of swages. The art of casting molten iron in moulds is

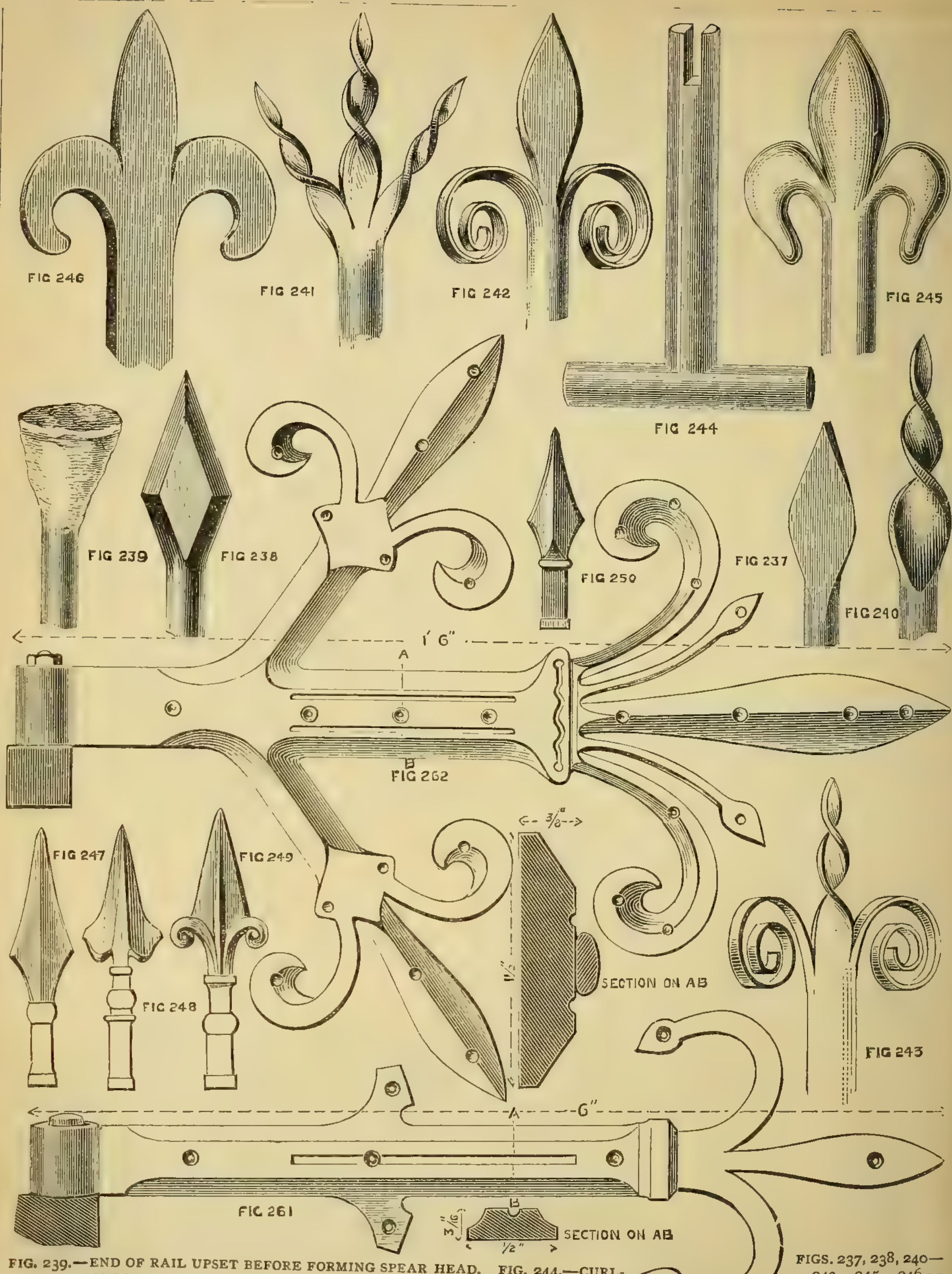
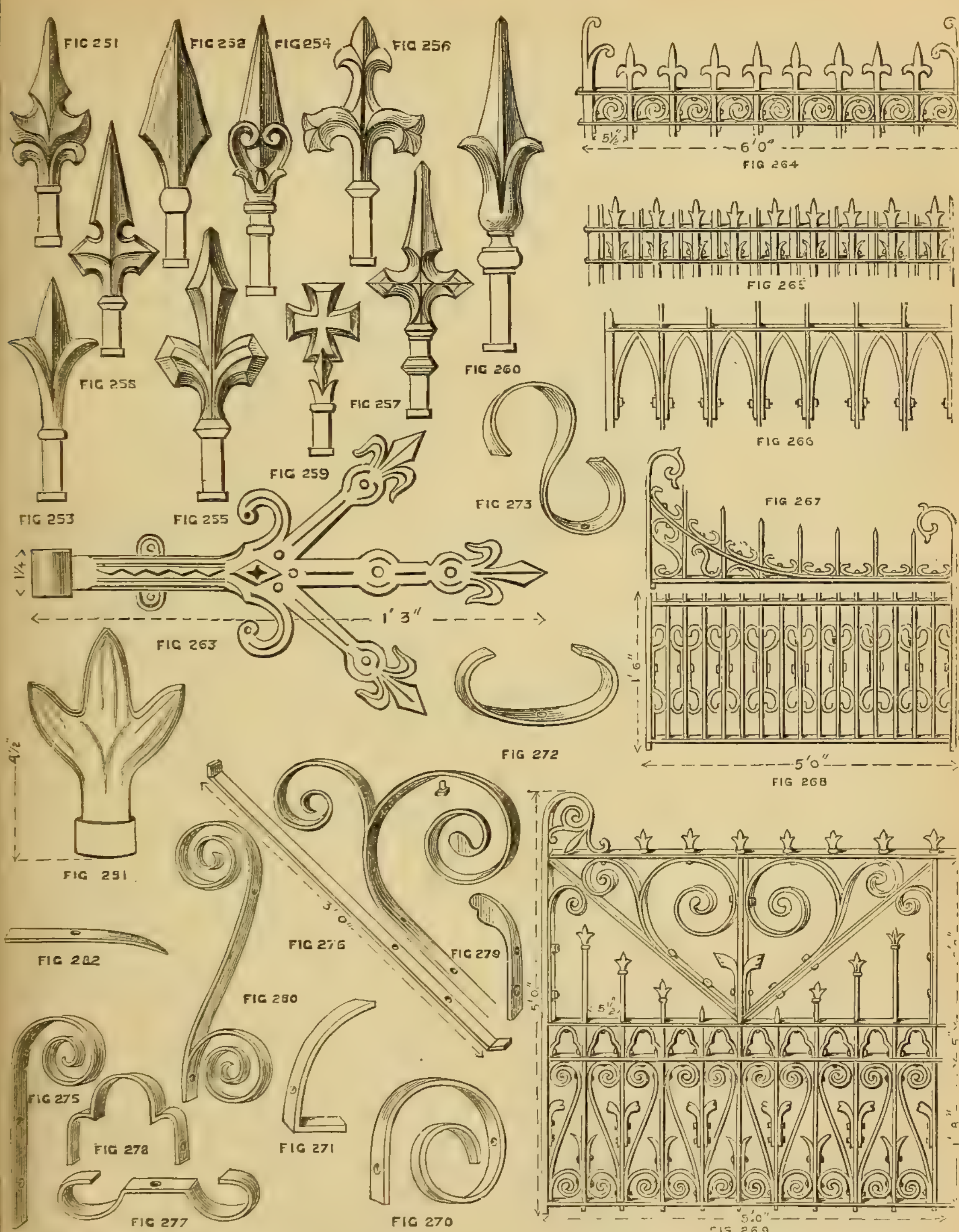


FIG. 239.—END OF RAIL UPSET BEFORE FORMING SPEAR HEAD. FIG. 244.—CURLING TOOL FOR SMALL IRON SCROLL. FIGS. 247—250.—STAMPED WROUGHT-IRON RAIL HEADS. FIGS. 261, 262.—DESIGNS FOR ORNAMENTAL WROUGHT-IRON DOOR HINGES.

FIGS. 237, 238, 240—243, 245, 246.—WROUGHT - IRON RAILING HEADS.



FIGS. 251—260.—STAMPED WROUGHT-IRON RAIL HEADS. FIG. 263.—ORNAMENTAL WROUGHT-IRON DOOR HINGE. FIGS. 264—269.—DESIGNS FOR ORNAMENTAL WROUGHT-IRON GATES. FIGS. 270—281.—PARTS OF ORNAMENTAL WROUGHT-IRON GATES. FIG. 281.—WROUGHT OR STAMPED IRON HEAD FOR GATE RAIL.

named "founding," and the artist "a founder." As he works in a "foundry" specially fitted up with costly appliances, we have nothing to do with him or his work, other than to note in passing that the smith brings in some cast-iron ornaments, and blends with them some of his own handiwork, as in the manufacture of fences, etc.

In large iron factories, where a multiplicity of ornamental designs in one pattern are required, the drop press is used to stamp the designs in wrought iron. Steel matrices or dies have the desired pattern cut in them, one die forming the anvil, and the uppermost one the head of the press. The iron to be formed, is first forged nearly to shape, then made white hot, inserted in the lower die, and the top die brought down sharp on the top. This process is also beyond the province of the amateur. It is probable, however, that many of the beautiful uniform designs found in antique iron work were produced by these or similar methods. Iron lecterns, screens, and other ecclesiastical iron work, in beautiful designs, are cut out of sheet iron and other metals by machinery working steel band saws. The work is nearly analogous to that of fretwork in wood, but the saws must have a splendid temper to cut sheet iron one inch in thickness! This, I am informed, is done by a Parisian firm of metal workers.

Ornamental iron work on a small scale only can be attempted by the amateur smith with hammer, chisel, and file as tools, supplemented by a lathe if he is the fortunate possessor of one. Much ornamental work in the manufacture of fences, gates, hinges, latches, bolts, stays, locks, etc., can be done with the hammer alone. Fig. 237 shows a simple spear head formed of wrought iron on the head of a ½ inch railing rod. To make this, first heat the end of the rod to a welding heat, draw out a point, then flatten this to form the spear head. Fig. 238 shows a larger and more pronounced form. To make this, first heat and upset the end of the rod as shown at Fig. 239, then draw out a point, then flatten and finish off the head. Fig. 240 shows a spiral end for an unclimbable fence rod. To make this, draw out a long point, flatten to a uniform thinness, then make red hot, put quickly in the vice and give it the needed twist. Fig. 241 shows a trident of three spirals. The two side-pieces of a lighter iron must be first welded on, then the three must be consecutively pointed, flattened, and twisted. Figs. 242 and 243, show some modifications of the trident form in which the side additions are bent, to form curls. This is done with a pair of small pincers, or with a tool shaped as shown at Fig. 244, the flattened points being caught whilst red hot in the prong of the tool and curled. In Fig. 245 is seen some side additions to the spear-headed form, thus transforming it into a *fleur de lis* pattern. Fig. 246 is an easy design for the top of a fence bar, having a square section. Figs. 247 to 260 show designs of some wrought-iron stamped heads suitable for railings, palisading, or gates, made and sold by Messrs. Bayliss, Jones, and Bayliss, *Victoria Works, Wolverhampton.* These beautiful specimens of ornamental ironwork done by dies and the drop press, are as cheap as they are beautiful, the prices ranging from 16s. per 100 for ⅝ and $\frac{7}{16}$ sizes in the simple patterns, up to 160s. per 100 for three-quarter square sizes in the more intricate designs. Those of my readers who intend making their own ornamental iron work in which these heads are desired, will do well to send to the makers for an illustrated list, choose the heads from the list, get them from the works, and attach them to home-made rails.

A feeling of veneration for an ideal and supernatural power, has often inspired men's minds to higher flights than those attempted for mere love of reward or personal honour. Hence we find the fanes of man's religions embellished with the best of material procurable, worked up in the best manner known to the age in which these were erected. When we visit our old parish churches and gaze with pleasure on the beautiful designs so faithfully worked out in stone, and wood, and iron, we can only come to the conclusion that the devout artisans of the period in which these were executed, deemed only their best work fit to be placed in the immediate presence of the Most High Creator of all things. Even now, the work of those ancient smiths, displayed in the ornamental ironwork on doors and screens, excite the wonder and envy of skilled workers in iron. If men could then, in those days, with their imperfect tools, work out such designs in such an excellent style, what should be done by us now? Doubtless, something superior, were we animated by a similar spirit.

I can only stay to give three examples of wrought-iron work as applied to hinges of church doors, and I have selected these from among many, because of their simple excellence and the adaptability of the designs to the skill of my readers. These are shown at Figs. 261, 262, and 263. Other designs may be inspected on the doors of many parish churches, such as those of the south door of Sempringham Church, Lincolnshire; the west door of St. German's Church, Cornwall; the south door of Durham Cathedral; Farringdon Church, Berks; and at St. Alban's Abbey, Windsor.

Ornamental wrought-iron work is seen to good advantage on entrance-gates to palatial residences, on garden wickets, on window guards, and in palisading or dwarf railings. At Fig. 264 is given a design for the top of a garden wicket, or half of a pair of

folding entrance-gates. An enlarged illustration of the scroll in this pattern is shown at Fig. 270. Fig. 265 shows a design for the top of the lower panel of the same gate, or the middle across the centre of the gate. The ornamental additions are shown enlarged at Fig. 271. Fig. 266 shows another design for a wicket or half of a pair of folding entrance-gates, whilst Fig. 267 shows the lower panel of the same. The curved ornaments between the tops of the bars are shown enlarged at Fig. 272, and the S scrolls at the top left-hand corner are shown at Fig. 273. At Fig. 268 is shown the ornamental effect of pieces of iron bent into the form of a pointed arch, and inserted between the bars of a gate or fence. Fig. 268 shows a beautiful but easy design for an entrance-gate. Only half of the gate is shown, and it will be seen from this that the design may be utilized for a smaller gate if required. Although the design appears at first sight to be an intricate one, on a closer inspection it will reveal some beautifully simple details, the combination of which has gone to make up the pleasing composition of the design. The top panel is divided midway by a vertical bar running also through the lower panel. These spaces are crossed by two diagonals made as shown, Fig. 274. To these are fastened, by means of screw studs, the double scroll, Fig. 276, and this is also secured by the same means to the top horizontal, and the middle vertical bar of the gate. The simple scroll, Fig. 275, fastened by studs to the side vertical bars, and the same addition, Fig. 279, secured in a similar manner to the middle vertical bar, fills up the top panel. Next come two middle horizontal bars, about six inches apart, dividing the upper from the lower panel, and the space between these is filled in with lengths of $\frac{1}{4}$ inch flat iron of the required width bent as shown at Fig. 278. The lower panel between the bars is effectively filled in by pieces of iron bent to the forms of the double scroll, Fig. 280, and the small additions shown at Figs. 279 and 282. The tops of the bars are ornamented with heads as shown at Fig. 281, and these can be easily made to screw on to the tops of the bars, or into the top horizontal of the gate. It will thus be seen that the execution of this beautiful design is quite within the province of an amateur smith, since every part of it can be made out of light iron, fashioned with the hand hammer alone, and put together with a few screwed studs. This remark applies to all the designs selected by me, for all may be made in parts singly and then put together with studs. These may be in the form of short bolts with ornamental heads and nuts, or short bolts with square heads and threaded ends, such as that shown at Fig. 276. Bolts and studs of $\frac{1}{4}$ inch section will be sufficiently stout, and, where studs are used, the holes in the bars and stays must be tapped with threads to suit those on the studs. Bars of rectangular or square section are employed in such ornamental work.

Stamping and Swaging.—I have already referred to some pretty specimens of railing heads produced by stamping iron with dies whilst the metal is at a white heat. Useful and ornamental articles may be multiplied to any extent, in uniform sizes and design by the same process after the dies are formed. The success of this art is due to the known plasticity of wrought iron at the white or welding heat, when it may be given any shape or made to take any pattern desired. The dies are made of cast steel, or they may be made out of tool or shear steel. They may be made wholly of steel, or only of iron faced with steel. After being forged to the required shape and size, a rough outline of the design may be punched or stamped in the faces whilst these are hot, then the tools should be heated to a blood red, covered up well with a pile of red-hot cinders, and allowed to cool down in the pile for twelve hours or more. At the end of this time they should be soft enough to be cut with a cold chisel, when the design may be cut in them. After the design has been cut in both dies, the faces should be ground quite level, so as to make them fit each other, and then the whole tool heated and hardened. Stamping dies to be worked by hand should be made similar in outward form to that of swages, fullers, and setts. A useful form is shown at Fig. 283. In this form the lower die rests on the anvil, with the top die held above it by the steel spring. The forging, previously fashioned by the hammer nearly to form, is heated to a white heat, placed in the lower die, the top die is closed down on it by pressing the spring with the left hand, and the top die is struck with a heavy hammer held in the right hand, one or two heavy blows being sufficient to close the two dies.

When a bar of iron has been upset, scarfed, and welded to another bar, it is found to be a difficult job to get the welded part uniform in shape and size with the rest of the bar by mere forging with the hammer on the anvil. To overcome this difficulty, a set of tools have been invented and named "swages," or "top and bottom tools." In some smithing operations connected with the manufacture and repair of machines, these tools are shop necessaries equally with those of hammer and tongs. Without proper swages it would be impossible to manufacture some parts of the machines, abounding as these are sometimes with cranks, collars, and other parts needing special tools to fashion them. The shop of a machine smith should be well stocked with swages furnished with grooves of all conceivable sizes and of various sectional shapes, to suit round,

half-round, oval, diagonal, square, and rectangular bars of iron. It is usual to have a set of both top and bottom tools for all sizes and shapes in general use. The bottom tools are made to fit like setts, in the square hole on the tail of the anvil. The top tools are held in hazel rods or in iron rods similar to those employed in holding fullers and top setts. For out-of-the-way sizes and shapes, a swage block (see Fig. 284) is provided instead of so many bottom tools; this is furnished with a large variety of grooves on its four edges, and is perforated with various-sized and shaped holes. These last are used as gauges to determine whether or not the welded part of the bar has been reduced by swaging to the size and shape of the remaining part. Swages may also be made in duplicate, and coupled together by a steel spring as shown at Fig. 283, for use by a smith working single-handed. They may be made of steel throughout, or of steel-faced iron. The method of making them is similar to that for making fullers and setts, recently described in this series of papers. Figs. 285 to 288 show some forms of swages, and Fig. 289 shows a set hammer used in a similar manner to that of a swage, in forging square shoulders to the ends of square bars. Fig. 290 shows how the top and bottom swages are used in reducing a weld to a round and uniform bar. In reducing a weld by means of swages, the iron is worked at a red heat and heated as often as may be required, until the proper form and size has been obtained, care being taken not to overheat and thus waste the iron. The smith holds the iron in his right hand and works the swage or top tool with his left hand, whilst his assistant strikes the top of the tool with a light sledge hammer. The iron to be reduced is passed to and fro and twisted around

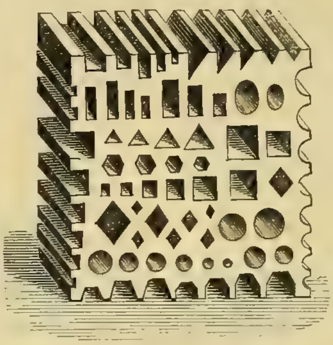


FIG. 284.—SWAGE BLOCK.

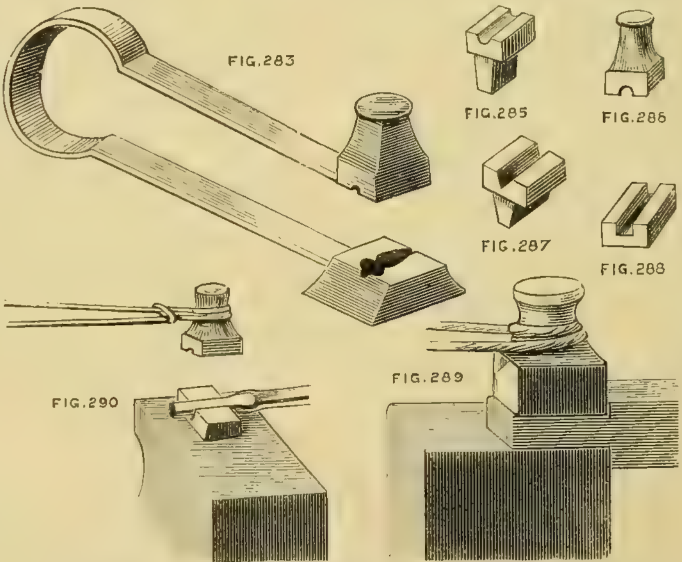


FIG. 283.—PAIR OF DIES COUPLED WITH STEEL SPRING. FIGS. 285—288.—SWAGES. FIG. 289.—SET-HAMMER SWAGE AND HOW TO USE IT. FIG. 290.—HOW TO WORK SWAGE.

in the lower tool when a round bar is required, or merely passed forward and backward in other forms, whilst the top tool is also lifted and placed on the lumpy part of the weld after each stroke of the hammer. After each heat has been worked off, the weld is sized and gauged, either in the swage block, or with a pair of callipers.

Ornamental effects can be produced on wrought-iron work by the use of fullers and punches. For instance, the deep grooves seen in Figs. 261 and 262, and also the zig-zag groove in Fig. 262, are made with fullers whilst the iron is hot. The lines in Fig. 263 are made in a similar manner with a lighter tool, whilst the curves are cut with a curved sett, such as that used in cutting the heels of horse shoes. Various indented patterns or designs can also be made with round, half-round, oval, convex, and concave pointed steel punches on hot iron. Some very pretty effects in iron rails of square section, in standards, stays, brackets, and other light iron work may be produced by heating the iron to a bright red whilst one end is held in a hand-vice, then put the other in a fixed vice, and twist the heated iron around as a rope is twisted until from 5 to 8 inches (more or less as required) has been made rope-like, the rest of the iron being left square. Flowers for the centres of scrolls can be formed out of sheet iron; first cut out with a cold chisel, then heated up, and the petals hammered to the requisite roundness on the anvil with the ball pane of a hammer. A hole should be drilled or punched in the centre or boss of the flower, and a round-headed rivet used to fasten this to its support. Before making up the material for ornamental work, it will be advisable not only to draw a general design of the whole to scale, but also make full-size drawings

of the parts on sheet iron with slate pencil. False marks can be rubbed out, and the design corrected until perfect; then a more permanent drawing can be made with white lead paint. Where many small parts in duplicate are required for the same design, they should be first cut out of sheet zinc or tin to the exact size and shape, and this used as a template whilst forging the real iron parts. Rough edges may be smoothed with a file, but it will be advisable not to trust too much to this tool, aiming rather at producing a finished surface with the hammer. Keep the surface of the anvil free from scale whilst finishing any tool or piece of ornamental work. Do not work with a hot-faced hammer or swage, but frequently dip these in water to cool them. This will help to keep the surface of the work free from bedded scale, and put a smoother finish to the surface.

(*To be continued.*)

THE "HEART OF OAK" HANGING BOOK-SHELVES.

A STUDY FOR WOOD-CARVERS.

By GEORGE ALFRED ROGERS.

(*For Illustrations, see Folding Sheet issued with this Part.*)

IT is easier for the amateur (until he has attained some proficiency in wood-carving) to execute designs composed of leafage, rather than the stricter and more rigid lines of conventional work or geometric patterns. A slip of the tool or a splitty piece of grain, may, with the unpractised, cause a break which can be easily remedied, by turning a leaf in another direction or folding it over or under, but with the curves or straight lines of geometric carving, these accidents cannot be so readily set to rights.

The design given in the Folding Sheet is not a difficult one. It is best to do, or have done, the carpenter's work first and the whole thing fitted together, and then taken to pieces again to be carved. There is then no risk of having your carving injured, during the process of making up the bookshelves.

The sides of this work should be prepared in wood about five-eighths of an inch in thickness, half an inch will do for the back. The shelves are of various substances as shown by the dotted lines.

A tracing of the design of the sides (Fig. 1) should be pasted on the wood which has been planed up for the sides, in order that the carpenter may see where the groove is to be made for the shelves. These sides will each consist of one piece of wood, but the back, the top of which is shown in Fig. 2, will have to be jointed, as the grain must be longitudinal, and oak cannot be obtained of such width as will be required. If you arrange to have a joint just below the top shelf and just below where the middle shelf comes, it will be better. The top joint of the back should be properly shot, but not actually glued up until the carving is done; as it would be inconvenient to carve otherwise. Oak, walnut, lime, or almost any wood will do for the purpose of this design, but oak seems the most appropriate, considering the character of the ornamentation. The back is not required to be lower than the bottom shelf.

The carpenter will rebate the sides, to receive the back as shown in section in Fig. 4. It will also be found advantageous to groove the sides to receive the shelves, which should be slided in from the back before the back itself is fixed. These grooves should not come through to the front, but stop a short distance from it, or an unpleasant appearance will be obvious. The diagram in section in Fig. 3 will explain the plan of sliding in the shelves.

The back will be fixed with small screws, three-quarters of an inch in length, and about six on either side. Supposing now, that the carpenter's work has been so far completed, the back should be unscrewed and the whole work taken to pieces for carving.

The amateur will now have to decide whether he will saw out the interstices between the leaves, and so have an open work carving, as shown in Fig. 1, or whether he will with his carving tools, ground out those parts left white in Fig. 1 (technically called the dead wood), and so have a solid carving, as shown in Fig. 6. If he chooses the former method, he will bore a hole in each of the spaces, to receive the saw of his fret machine, whether it be a treadle one or merely a saw frame for working with the hand. The saw is passed through these holes and fastened up tightly, and now the chief thing to do is to keep the saw upright—for if not, the ultimate operation of carving is rendered more difficult.

If the amateur, on the contrary, prefers to have his work in the solid, he will only have to fretcut the outer line of the design. This will be quite necessary. The carving is not to be commenced until the fret-cutting, or else the grounding, is complete. The depth of the cutting for solid grounding is indicated in section in Fig. 5.

Then comes the artistic work. Firstly, the formation of the hollow in which the leafage is to appear to be lying, as shown in section in Fig. 5, and after that is done the most pleasant part of the task begins—namely, the formation of the leaves and acorns, by carving hollows and rounds on them after the exquisite design of nature; each leaf should be different from its neighbour. It is in this part of the performance that the charm of wood-carving lies. The taste of the

student is called into play, and he has to decide which side of a leaf is to be depressed, which left to the full height of the wood, where there should be a hollow, where a raised projection. There are certain rules which may be given, but they are open to so many exceptions that they almost cease to be rules—viz., The stalks generally to be low; a hollow should run through the leaf, from its stalk on to one side or other of the end or top of the leaf. Other details will suggest themselves to the carver while he studies the work, tool in hand. It is difficult to carve from nature, there is so much to copy in her; one sees too much, and is overwhelmed with the impossible venture. It is, nevertheless, excellent practice if the student does not get disheartened. A dead leaf of an oak, which has dried on the ground where it has fallen, is a good study; better than live leaves picked off the tree, as they soon get flabby and lose their characteristic curves; whereas the dead leaf is rigid, and keeps the beautiful form in which it died.

All the foliage should be *bosted*, that is, carved roughly into the desired forms before any are finished. The finishing or smoothing is then carried all over the work; then the veining is put in, but not too many veins, if you please, not a quarter so many as in the natural leaf, or your work will look scratchy.

The work is now supposed to be complete and ready to be put together. The shelves should be run in from the back with glue, and the back screwed on, and the whole hung up for the admiration of your friends. I have one of these bookshelves finished in my studio, 29, *Maddox Street, Oxford Street, London, W.*, and any of the readers are welcome to see it, or photographs of it can be had, which will be found an assistance in modelling the leafage.

UPHOLSTERY AT HOME.

By DAVID ADAMSON.

II.—Materials—Colours—Upholstering Old Cane-Seated Chairs—Pin Stuffing—Holland Seating—Webbing—Stringing—Wadding—Covering—Putting on Gimp and Finishing.

IN the first paper of this series, a notice of some covering materials used by upholsterers was promised as the subject of the present article. It is unnecessary to name all that are employed, for new fabrics are constantly being brought out. Those that will be referred to are either instances of survival of the fittest from former fashions, or when they are new departures they are given because they seem to possess such intrinsic merits as to render them worthy of being ranked among the good standard materials, when, perhaps, many of their contemporaries shall have been forgotten in the ever-increasing restless change of fashion. It is, however, difficult, if not impossible to foresee what will remain popular; and some of the best of those now in use may become obsolete, while some whose qualities are not so readily discernible remain to the fore. The following list will, however, be sufficient for most purposes, including, as it does, all degrees, from dainty silk plush, whose sheen seems almost an embodiment of "the rich hues of all glorious things," to stern uncompromising hair-cloth—a material which though strong and sometimes prickly, and therefore irritating to sit on, is nevertheless eminently respectable, especially in conjunction with well-beeswaxed and turpentined mahogany; but with all its good qualities, it is not the material with which one would recommend the sybarite to have his favourite chair covered. Several that look better and are more comfortable, can be found without very great trouble, but as much could hardly be said to the contrary. Sheets of metal, such as zinc, tin, thin enough to be flexible, might be tried by those who fancy hair-cloth too luxurious, though I am not aware they are employed for upholstery purposes. Among the things that *are* used, leather stands pre-eminent, it having been employed from the earliest times in which we have any record of upholstery as such, in covering either temporarily or permanently, chairs and other seats. It may, therefore, fitly claim our first attention, but space forbids more than a short notice.

Morocco Leather is the skin of the goat, and is, without doubt, a good material, though like most other things it varies in quality. It is prepared with various surfaces, of which the principal are known as Hard-grain, Cross-grain, and Straight-grain, and may be had in any of them, either dull or bright. Dull is usually preferred owing to its superior appearance, but this is entirely a matter of taste. Other things being equal, the bright or polished skins wear better, if anything. All varieties can be procured in almost any colour. The value of morocco depends not only on quality but on the size of the skins. A large skin is one from which a 3 feet square could be cut, while medium size may be given as about 27 inches by 32 inches. Moroccos are occasionally stamped, or embossed with various designs.

Roan Leather is very similar in appearance to morocco, of which it is an imitation, so much so that it is sometimes difficult to distinguish one from the other without an inspection of the rough side. This is especially the case when new. It is a sheepskin, and does not wear nearly so well as morocco, for which it is sometimes substituted. In good class

work it is used only for the outside backs of easy-chairs and couches, where the wear is not heavy. It is not at all a bad material when of good quality, only it is not so durable as morocco, and, of course, it is cheaper.

Buffalo Hide, though not readily obtainable, is sometimes employed, and is chiefly or solely to be preferred to morocco, on account of its size and great strength. It can hardly be considered so suitable for general purposes.

Basil, Skiver, et hoc genus omnes, deserve no more than a passing notice, though much used in cheap low class furniture—of the sort advertised as being covered in "real leather," and picked up by bargain-hunters at prices very much below their ostensible value. "Real leather," in such cases, sounds much better then "rubbish," but it is often synonymous.

Spanish (?) Mahogany dining-room suites in "real leather," at infinitesimal prices, are got up to sell, not to last, at least if they are intended to be serviceable, they are not so. It is these and such like productions which have greatly tended to lower the status of an honourable and useful trade in the eyes of many who aspire to be our teachers in the construction of furniture—a subject on which most of them are profoundly ignorant. Let them instead of criticising furniture, or bewailing the incapacity of the craftsman to design or produce good work, unless under their own incompetent guidance—which by the way is generally ignored with the happiest results—show half the amount of zeal in endeavouring to convince purchasers that even in these days of keen competition, things cannot be manufactured and sold for half their value, and if by chance anything is so offered, trade buyers are quite sufficiently on the alert to pick it up. This though is only common sense, so it is a little unreasonable to expect such writers and talkers on Art to be so familiar with it as to attempt to teach others. The real reason for much of the bad furniture, and unfortunately there is a good deal with which fault may be found, lies not so much with the tradesman whose interest and desire it is, if he be an honest man, to produce good work at a fair price as with the purchaser in his, or quite as often her, anxiety to get a bargain by beating down prices, sometimes by the most transparent—well, say poetic licence—as it sounds better, than the little word beginning with L and ending with E. The anxiety referred to is often seen, but the "bargain" seldom has any existence save in the imagination of the purchaser.

Another leather occasionally used for upholstery is *Pig-skin*, which is more generally known as a saddle covering, but there seems no reason why it should not be suitable as a substitute for morocco leather. I am induced to refer to this article not so much from having had any extended experience in its use as because samples have been recently submitted to me by a firm who is making a speciality of preparing pig-skins on a large scale. Hitherto the use of pig-skin has been limited partly owing to its price and certain qualities which have prevented its becoming popular. Now, however, it is produced so as to be available at a very similar cost to the best moroccos—in fact, owing to the large size of the pig-skins and their consequent economical cutting, they are for some purposes probably at least as cheap as many of the high-class coverings. It will be understood that I do not speak from actual personal knowledge of this special manufacture, but I have heard such favourable opinions expressed about it from competent judges that I feel justified in departing from my usual custom in this instance. The manufacturers, a firm of the highest standing, are not known to me personally, so that there need be no idea that I have any interest other than that of a consumer in alluding to pig-skin. I am now testing its wear practically, and should I find later on that it does not come up to my expectation, readers may depend on my stating so before the present series of articles is concluded. Meanwhile, any reader who is interested in the matter may be satisfied to the extent of my knowledge by addressing to "Amateurs in Council." The skins are prepared in several colours and grains, both plain and embossed, like moroccos. Many of these embossed skins are very beautiful, and I can speak with unqualified approval of them, both as regards design and execution.

Velvets.—These, especially of late years, have run very closely with leather in popular estimation, and deservedly so, for there is nothing to surpass, or even to equal, them for wear. I am not now referring so much to the silk velvets or plushes, whose use is confined almost exclusively to drawing-room and fancy furniture, as to the coarser sorts, which may be used instead of leather for coverings in dining-rooms, etc. These are Utrecht or mohair velvet, plain or embossed; frieze, similar in appearance to the latter, but with the pattern woven instead of embossed or stamped. All are made in a very large variety of colours, and there is considerable range in price and, consequently, in quality. Occasionally those unused to them find the clinging feel of velvets at first objectionable, but this, if it ever exists except in the imagination, soon wears off, and those who have compared both leather and velvet do not, as a rule, prefer the former. The chief objection to velvet is from an upholsterer's point of view, because it wears too long. I have known some dining-room chairs in velvet which were in constant use for over twenty years, when, though they showed signs of wear and

had faded slightly, they were still perfectly good, and could not even have been considered shabby-looking. Had they been covered in even the best of leather the same could not be said.

Silk velvets or plushes are more delicate, and whether plain or embossed have a very beautiful appearance. They are made in the same colourings as the others, but there is not so much diversity in price.

Genoa Velvet is a variety which may be mentioned, but being an expensive material is, perhaps, not to be recommended for the amateur upholsterer—at least, unless he is a proficient, and it is not used except in the best class of work. As a rule the width of velvets is 24 inches, though the actual measurement in this, as in many other instances, varies a trifle from the nominal; while some fancy sorts, such as Genoa, are made in more than one width.

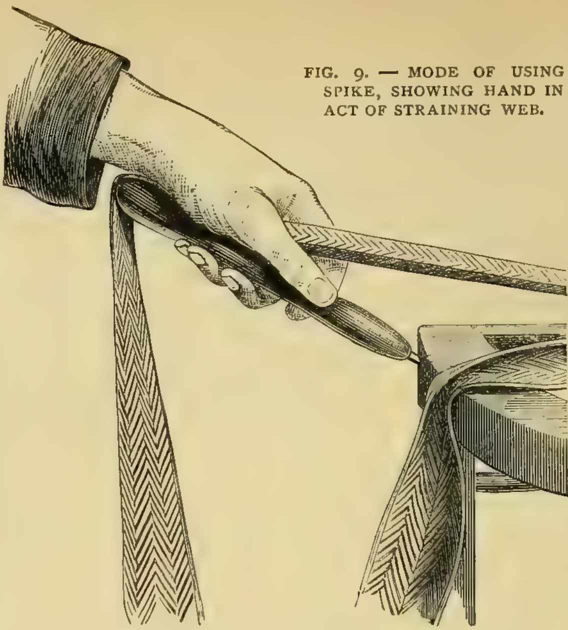


FIG. 9. — MODE OF USING SPIKE, SHOWING HAND IN ACT OF STRAINING WEB.

Velveteen is a cotton velvet and may be used as a cheap substitute for plush, to which it is much inferior, especially in appearance. It wears well.

Jute Plush is a cheap and very effective covering material, but not one of the most durable. It is made in widths of 50 inches. What are known as metal squares (15 and 22 inches) are similar, but with gold embroidered designs worked on the surface. They make up handsome small chair-backs and seats. Those worked in oriental or semi-oriental patterns are to be preferred.

Saddle-bags.—These have been much used lately, and they are at present among the most fashionable coverings for every description of chair, whether for drawing-room, dining-room, or library. In texture they much resemble velvet, but they are more of a carpet material, such as Wilton or Axminster—in fact, they are more like small velvet pile carpets than anything else. Their variegated colours arranged in oriental or "Turkey carpet" designs, give them a rich appearance, and they are very durable. In size they run from 18 inch squares up to 22 inches by 4 feet 6 inches. They are often called "Persian" saddle-bags.

Repps and Damasks are now considered as somewhat old-fashioned, but they have many good qualities which entitle them to regard.

Crape, or Orient Cloth, also sometimes known as "oatmeal" cloth, is a sort of repp, from which, however, it differs considerably.

Tapestry is the material which has largely superseded repps, etc. It is made in an almost endless variety of patterns and qualities. As a rule it wears well, even the cheapest sorts comparing favourably with other stuffs of similar values. It is made 1½ yards wide (or "six-quarter" width).

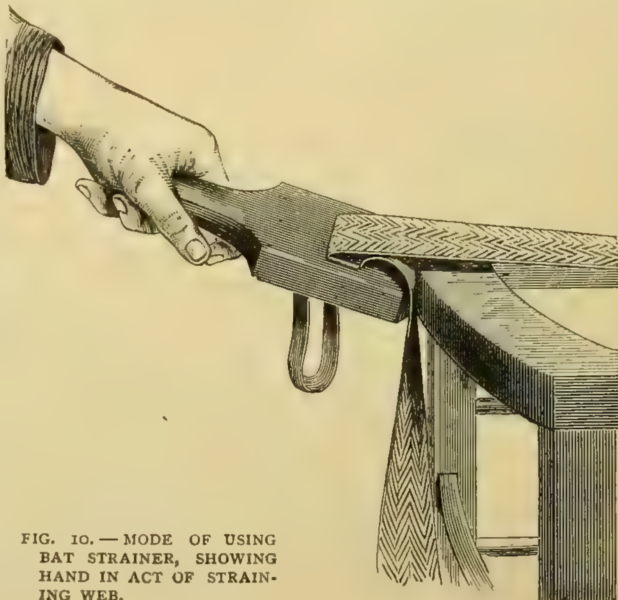


FIG. 10. — MODE OF USING BAT STRAINER, SHOWING HAND IN ACT OF STRAINING WEB.

Cretonne and Chintz are cotton fabrics with the design printed. They are economical coverings, and if well chosen for the purpose they are to fulfil there are few materials that look better, and they wear fairly. It is seldom, however, that the lowest qualities are good enough for upholstery purposes, other than drapery, for which they are well enough adapted. Some cretonnes are reversible, or rather show a pattern on both sides. Tapestry cretonne, as its name indicates, is an approach to a tapestry

FIG 1. SIDE OF BRACKET BOOKSHELVES. FULL SIZE.

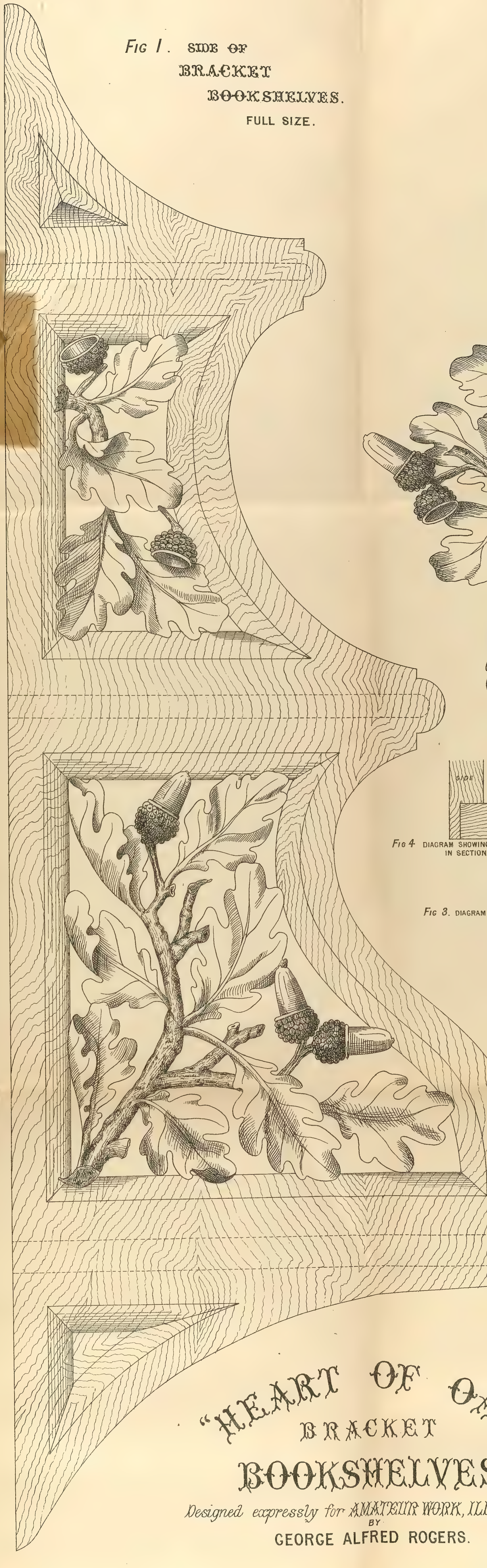


FIG. 2. CARVED WORK AT TOP OF BACK. FULL SIZE.

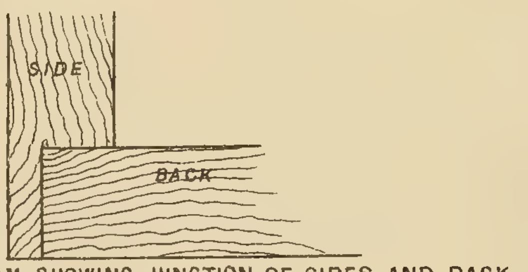


FIG 4. DIAGRAM SHOWING JUNCTION OF SIDES AND BACK. IN SECTION FULL SIZE

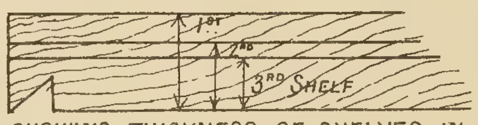


FIG 3. DIAGRAM SHOWING THICKNESS OF SHELVES IN SECTION FULL SIZE

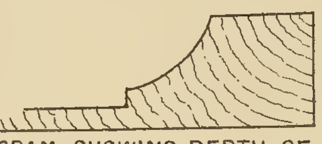


FIG 5. DIAGRAM SHOWING DEPTH OF CARVING. IN SECTION. FULL SIZE.

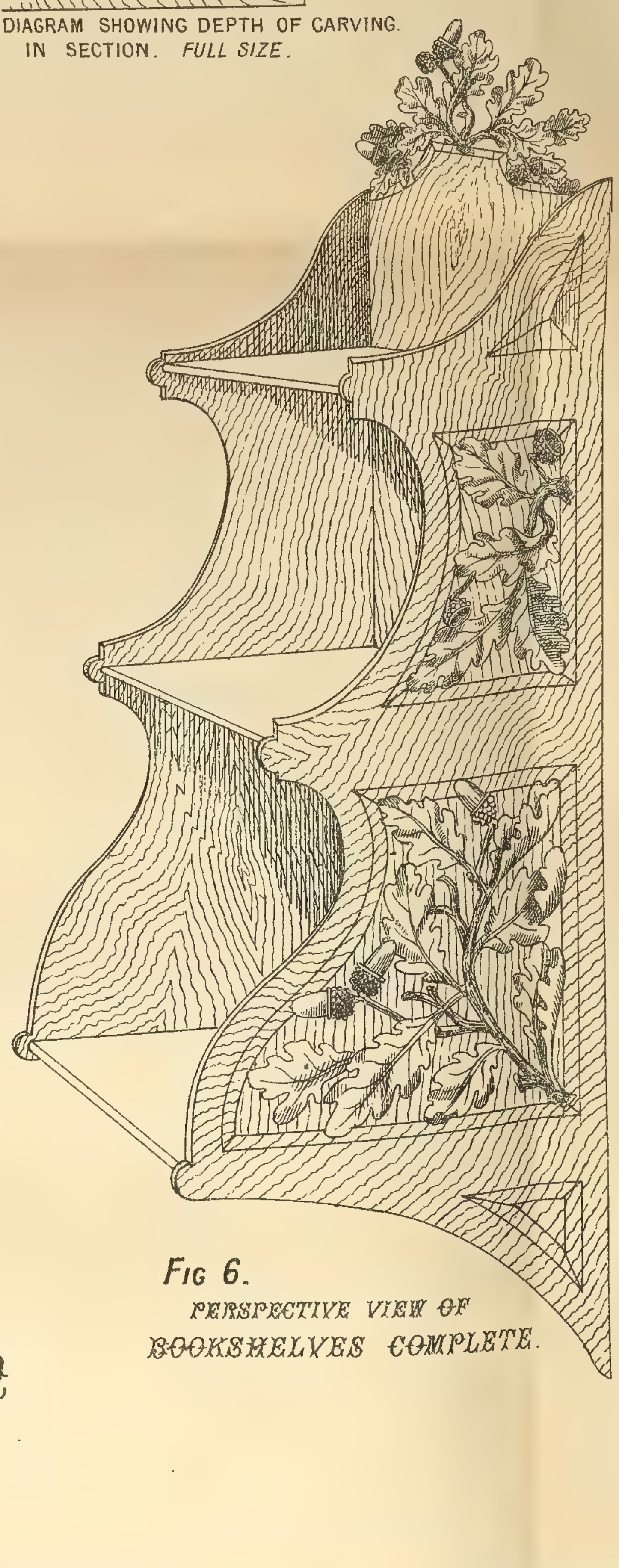


FIG 6. PERSPECTIVE VIEW OF BOOKSHELVES COMPLETE.

"HEART OF OAK" BRACKET BOOKSHELVES.

Designed expressly for AMATEUR WORK, ILLUSTRATED, BY

GEORGE ALFRED ROGERS.

WITHERBY & CO. LITHO. 325A, HIGH HOLBORN, LONDON, W.C.

WARD, LOCK, AND CO., WARWICK HOUSE, SALISBURY SQUARE, LONDON, E.C.

appearance, and is the same width as it, ordinary cretonne being 33 inches.

Silks and Satins are to be had in large variety under various names, but it is not necessary to specify them here.

Leather Cloth.—This is an imitation of leather. It is a cotton backing, faced with a preparation dyed and grained in various ways to resemble leather. Crockett's leather cloth has a deservedly high reputation, and the quality of this make can always be depended on. Few of the leading upholsterers use any other, and the amateur should insist on having it unless he can get a good judge to give a favourable opinion of other sorts that may be offered, as most of the imitation leathers that I have come across are not what I would care to use.

FIG. 11.—PINCUSHION STUFFED SEAT, SHOWING COVERING TACKED UNDER.

Hair-cloth, or Hair-seating, as it is often called, has been already referred to. It was formerly much more general than at present. Chippendale and his contemporaries used it extensively, and even till comparatively recent years it was a favourite covering. It is not seldom seen on high-class work. When of good quality it wears very well, but it is generally considered by old upholsterers that it is not now made so well as it was,* and that the quality for some years has been deteriorating. It is usually black, but is to be had dyed in various colours, and occasionally it is figured in the weaving. It is made in widths of from 16 inches upwards. There is also an imitation of hair seating which should be avoided as unserviceable.

Penelope Cloth is a material which deserves to be much more widely known than it is, but having only been introduced within the last few years there has not been much time for it to become popular. It is a fine moleskin, dyed any desired colour, either plain or embossed. It is very cheap, looks and wears well, and has a comfortable feel.

Various other coverings, such as Tournai, Pekin cloth, Terry, Coteline, Turkey cloth, etc., need not be more than alluded to for the benefit of those whose appreciation of good things is not limited by a negative answer to the question, "Is it in the latest fashion?" Many of them are excellent materials, and there seems to be no reason, other than fashion, why they should not be much more extensively used than they are now.

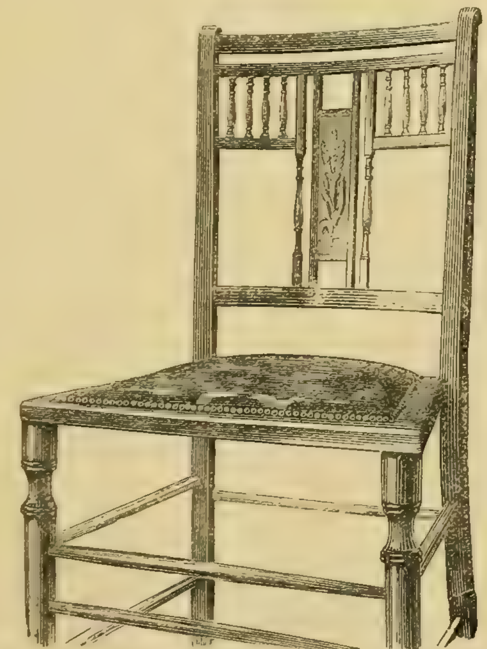


FIG. 12.—PINCUSHION STUFFED SEAT, SHOWING MOULDINGS.

Those who do not altogether care for the dull colourings now so prevalent will find something more to their taste in those materials which are just a trifle out of date. For the last half-hour I have been examining a small heap of cuttings of the above-named materials, and I can't help a dim consciousness that we are perhaps wrong in discarding all that is brilliant in colour, and that our admiration of muddy tones is an affectation. Am I wrong? Time will show,

* This, to my mind, vile, execrable, and ever-to-be-forsworn material, to judge of the unhappy experiences of my childhood, whenever I was brought into contact with it, could never have been made very well, that is to say, so as to keep the ends of the hair in proper subjection.—ED.

if, indeed, already there is not an indication of a reaction in favour of cheerful hues. Surely in this dull climate of ours we need not try to imitate the gloom of a November fog in our dwellings. We have enough of the real thing almost any time outside them. Looking up at the grey green walls of the room in which I am, and on to the curtains of indescribable green, wherein lurk mysterious hints of other hues, I am almost tempted to ask whether something more lively-looking would really be such a strong evidence of depravity—I mean in an artistic sense—as some ultra æsthetic people would have us believe. But my good steel pen, pull up, for are not you and I writing words of dreadful heterodoxy, even though we are but uttering a mild protest against the exclusion of our old friends the three Primaries and their nearest relatives the Secondaries in order to make way for somewhat sad, if restful, "far awa' cousins." We are glad to see them all, shady characters though some of them are, as members of the family of Colour and of our own generation. Still we would like to see the old people occasionally, for they are bright and cheerful, even if they are in the estimation of some of our over-refined young friends a trifle vulgar and not to be compared with their carefully-toned relatives, the Mud-Colours. Stay—stay—enough, *penna mea;* we shall lose caste altogether if anybody hears us whispering like this. Let us proceed to tell how a chair may be upholstered.

It often happens that the cane seat of a chair is worn out while the frame, as the woodwork of a chair is technically called, remains in good condition. The upholstering of such a chair is a simple piece of work, perhaps the simplest an upholsterer has; and there are few houses in which there is not a more or less dilapidated cane seat, for cane-seated chairs seem in some strange way to induce their owners to ignore the fact that they are not intended to be used in place of a small step ladder, with the result that sooner or later a foot of the person standing on it makes a hasty attempt to get from the top of the seat to the floor, by the shortest and most direct route. The result is eminently satisfactory to any wishing to repair the seat. Amateur upholsterers who have not got a chair with a damaged seat, are at liberty to avail themselves of the hint. It is immaterial whether the cane, that is, if not broken, of the chair which it is desired to upholster, be left on or not as the work is the same, except that no webbing will be necessary, as the cane if sound will serve instead of it. For the sake of completeness, however, I shall assume that the cane having been broken has all been removed, and that the chair is to be completely upholstered. Having filled up the holes in which the cane was inserted, place the frame on its legs on the table or bench, with its front legs facing you. The top of the seat ought to be just so high that the work, hammering, etc., can conveniently be done while you stand to it. The first material wanted is a piece of black holland rather larger than the chair seat, using ½ inch or ⅝ inch cut tacks; begin by fastening the holland in the centre of the back frame of the seat, and on top of it, after having turned over, not under, about 1 inch of the holland, keep the tack as near the front or inner edge of the seat rail as may be convenient, say within ½ inch or so, but much will depend on the width of the seat frame; and here I may state to avoid useless repetition, that by frame I shall only mean seat frame, not including the remainder of the woodwork. As each succeeding layer, so to speak, of the upholstery will overlap the preceding one, the object to be regarded in the position of the first one, the holland, is to get it so placed that the last one, the final covering, will not go beyond the outer edges of the frame. It may be as well here to explain that the seat of this chair is intended to be what is known as "pin," or as it is sometimes called "pin-cushion" stuffed. At the same time, the tacks must be sufficiently far from the edge to have a good hold, and not break away the wood. From the centre back, at intervals of about 1½ inch, work in other tacks all of them through the turn-over of the holland, so that each tack goes through two thicknesses of it. The holland at the back being tacked down, work along the right side from the back to the front, in exactly the same way, straining the holland with the left hand and hammering with the right. Then strain very tightly to the left hand front corner and drive a tack in there, the same distance from the inner edge of the frame, as the other tacks. Proceed with tacking along the left hand side, and after it the front, working from the centre. The tacks should be well driven home in a regular line and the holland evenly strained. As the holland is only used for the sake of appearance, it may be omitted if preferred, or any other material used instead. I say holland, because it is the customary one. The next process is webbing. Two pieces will be required from back to front, and two from side to side; set out the back rail so as to leave equal spaces between the two webs, and between each of them and the side rails, that is three spaces with a piece of web between each. As with the holland start at the back, turning over ½ inch of the end of the web, fasten down to frame with four ½ or ⅝ inch tacks, bring the web forward and place it over one end of the strainer, which is held in the left hand, as shown in Fig. 9, if the spike strainer is used. The other end of the strainer is placed against the front rail of the frame (also Fig. 9), and as the upholstery

will not cover this, a piece of wood should be placed against it to prevent injury from the spikes. I think it will be clear that if the raised end of the strainer be depressed, the effect will be to draw the web very tight. The web being tightened while still holding the strainer down with the left hand, with the right hand drive home four tacks through the web into the frame, after which the strain can be relaxed. Cut the web off ¾ inch in front of the tacks, turn over the loose end and tack down with one tack, to prevent it fraying up. The same proceeding is carried out with the other pieces of web, fastening the side-pieces on the right hand first. The pieces of webbing must be interlaced, that is, each piece must go alternately under and over the pieces to which it is at right angles or crosses. Fig. 10, I think, will help to understand how the bat-strainer is used. The web is formed into a loop, and passed through the hole an inch or two, the wedge is then put in its place, so as to prevent the loop being withdrawn from the hole, and on the strain being applied in the same way as with the spike stretcher, it is firmly held. I don't kn w whether it is necessary to say that the web loop must be put in at the smaller opening of the hole and come out at the other. It will not be necessary as there are no spikes in the bat-strainer, to put a piece of wood between it and the frame, but a piece of some soft material to prevent bruises is advisable. As a great deal depends on the webbing, no pains should be spared to do it properly and have each piece well strained. The illustrations are from photographs, taken expressly for the purpose, from an upholsterer actually at work at the stage they represent, so they may be taken as strictly accurate. The chair frame, however, is not of exactly the same sort as the one described now. I merely mention this to prevent confusion, for the procedure is identical, except that no protecting material was being used between the strainer and the frame, which in this instance was to be entirely covered.

The web being fixed, proceed with a piece of coarse canvas (Hessian) exactly as with the holland.

The next process is stringing. Put a tack in each corner, but do not drive them home. If the chair is a large one, tacks may also be put in the rails at intervals of about 5 inches, but in an ordinary sized bedroom chair this is not necessary, though it will be as well to put one in each side, and perhaps in the front, if this is very much wider than the back; then get some ordinary thin upholsterer's twine, *i.e.*, stitching twine, or whip-cord, tie the end of it to the right hand back corner tack, pass it round the left hand corner one, leaving it sufficiently loose to allow of two fingers one over the other being placed between it and the frame. Continue the same round the chair to the tack whence the start was made, and from it diagonally across the chair to the left hand front corner tack, loosely as in going round the frame. The string where twisted round the tacks will be firmly held by them on their being hammered down. The object of this stringing is to afford a sort of support in distributing the hair, or whatever material may be used for stuffing. As only a small quantity will be required for a chair of this kind, it is hardly worth while to use anything but hair. This should be well opened out or loosened with the fingers. Work a small quantity evenly under the string all round, taking care to equalize the distribution, not putting it in lumps at some parts and at others the merest sprinkling. After doing so all round, work some under the string lying across from one corner to another, packing it a little more firmly, and seeing that the hair is equally and evenly placed all over. Then get a piece of calico, tack it temporarily with one tack to centre of back, next one in centre of front, one each in the right and left hand front corners, and two on each side. The calico at this stage should not have been drawn too tightly over, but neither should it be baggy and loose; then sit down on the chair for a moment or two, as if the stuffing has been properly distributed, the weight of the body ought to be sufficient to equalize it, and, of course, somewhat compress it.

Cut the calico all round, ¾ inch outside tacks. Take the back tack out and turn the surplus ¾ inch of calico, ***under***. Drive home tack where it was before temporarily, and stretching the calico somewhat tighter, working from this tack drive in ⅜ inch tacks every 1¼ inch. Then do the same in front, always working from the centre, pulling the calico tighter, and smoothing it with the left hand as the work proceeds. It will be better to put the tacks in alternately on each side of the centre till the corners are reached, when the right side is done in the same way, and finally the left. All these tacks must be driven well home, otherwise they might be perceived through the covering, and in pulling the calico, take care that the stuffing is not displaced. Keep it well up towards the centre, so that the seat presents a good even surface slightly convex in form.

Some wadding is now required. It may be either white or dark according to the colour, etc., of the covering material. For a thin light material use white, for a dark one, the other. For some covers, such as leather cloth, it is immaterial which is used. The wadding should be cut to the shape and size of the seat, on which it is laid with the woolly side up. The chair is now ready for covering. Almost anything may be used; in this instance, cretonnes, for example, would do very well in a bedroom or leather

cloth if the chair is for any other room. Whatever is decided on, it should be cut $\frac{3}{4}$ inch larger than the seat, less might be done with by an expert upholsterer if necessary, but it would not be advisable for a novice. Proceed with it as already directed for calico, keeping the tacks a little outside those already in. Some gimp or banding will now be required to fasten round the edge of the covering, and give the seat a neatly-finished appearance. Gimp of a colour suitable to the covering should be chosen, or, instead of gimp, if the covering is a leather, a leather banding may be used with advantage. It should be of the same colour as the covering. Whichever is used, it is fixed in the same way. Begin by what is called "back tacking" it. This is rather difficult to explain, but I think the meaning will be gathered by following these directions. Take the gimp or banding, and lay a few inches of it reverse side up on the back rail, with the end about the centre, close to the end fasten it down with a tack. Now pass the gimp over towards the right hand of the chair, thus bringing what was the under side to the top, and proceed to lay it round the seat so as to cover the juncture of the covering and the wood. Work from the centre of the back towards the right along the right side, front left hand side, and back to centre. When near this, say within 1 inch or so, take a piece of thread and wrap round the gimp to prevent ends fraying half inch beyond the length required. Do the same again a little further along the gimp, if there is a sufficient quantity over to be worth putting away. Cut off between these two threadings and turn the loose end of the piece on the chair under, so as to meet neatly the gimp where the start was made. The chair is now complete. The gimp pins should be from $1\frac{1}{4}$ to 2 inches apart, and $\frac{3}{8}$ inch size. If what is known as scroll gimp has been used, the heads of the pins may be covered by a little manipulation with the gimp, of which a strand may be lifted for the purpose and put over the pins. With braid gimp the pins show.

If leather banding is used, it looks better instead of pins to fasten it down with studs, which may be either leather covered to match, or plain brass or coppered. With banding, it is necessary to fasten down with a tack or gimp pin temporarily every 6 inches or so, as the pins of the studs being weak, it is necessary to bore holes for them with (pritch) awl. If preferred, the tacks may be dispensed with altogether, but if used, place them so that a stud comes over each, but this is not so workmanlike a plan. The studs, of course, should be placed at regular intervals marked out with a rule, or, better, with compasses. One every $1\frac{1}{2}$ inch will do very well, taking care that they are so arranged that one comes properly in each corner, and one just over the join where the two ends meet. Instead of gimp or banding, studs placed as close together as they will go may be used; if so, plain metal—brass or copper—look best, and especially with a velvet covering present a very rich appearance. Though a bedroom chair has been instanced as the example, it does not follow that pin-stuffing is only applicable to such, for it is a method that is much used even in expensive fancy drawing-room and other chairs.

It is, however, necessary that the wood of the frame on top and at the edges is sufficiently good to be seen. In chairs specially made for pin-stuffing, the inner edge of the frame is slightly rebated. If it is not considered desirable that any of the wood of the frame (*i.e.*, of the seat) should show, it is only necessary to keep the upholstery as near the outer edge of the top as possible, and carry the cover over so that it may be fastened underneath the frame. In this case, a fringe hanging down from the lower edge of the frame may be used with advantage instead of gimp. In other respects, the procedure is as described. Figs. 11 and 12 show the proper appearance of pin-stuffed seat, with both methods of attaching coverings.

(*To be continued.*)

ELIZABETHAN FURNITURE.

WITH PRACTICAL HINTS FOR ITS CONSTRUCTION.

By Rev. ALGERNON THOROLD, M.A.

I.—FURNITURE OF ANCIENT AND MEDIÆVAL TIMES—ANGLO-SAXON FURNITURE—ROMAN FURNITURE.

THE pages of this Magazine have for so long been open to the clever suggestions and practical instruction of amateur workers in wood, that any attentive disciple of the bench, into whose hands they have fallen, might, providing he had been so minded and due time was at his disposal, have partly, at least, furnished himself with the chief necessities of a family man, and given proof in most of the rooms of his house, that an amateur carpenter is a person who may fairly claim unfeigned respect for his work's sake.

The carpenter must have been a person of great importance from the very earliest times, and to the great proficiency of one man in this art, eight persons once survived an overthrow which left the builder of their floating house of gopher wood alone the master-hand of his trade in all the wide world.

The history of all early woodwork is full of interest, but, owing to the perishable nature of the material used, few specimens of an early date have come down to us ; and even were it otherwise, it

would be impossible within the limits of this and subsequent articles to touch at all upon the characteristics of work further back than a few hundred years.

The title of this paper will perhaps sufficiently convey to my readers that I am desirous of introducing to them some practical observations on the domestic woodwork, or furniture as it is called, of the 16th and 17th centuries, with the object of tempting them, if possible, to try their hand at the manufacture on sound principles and after old and genuine designs, of a few of the quaint and beautiful pieces of furniture in use at the time mentioned, one of which is shown in Fig. 1.

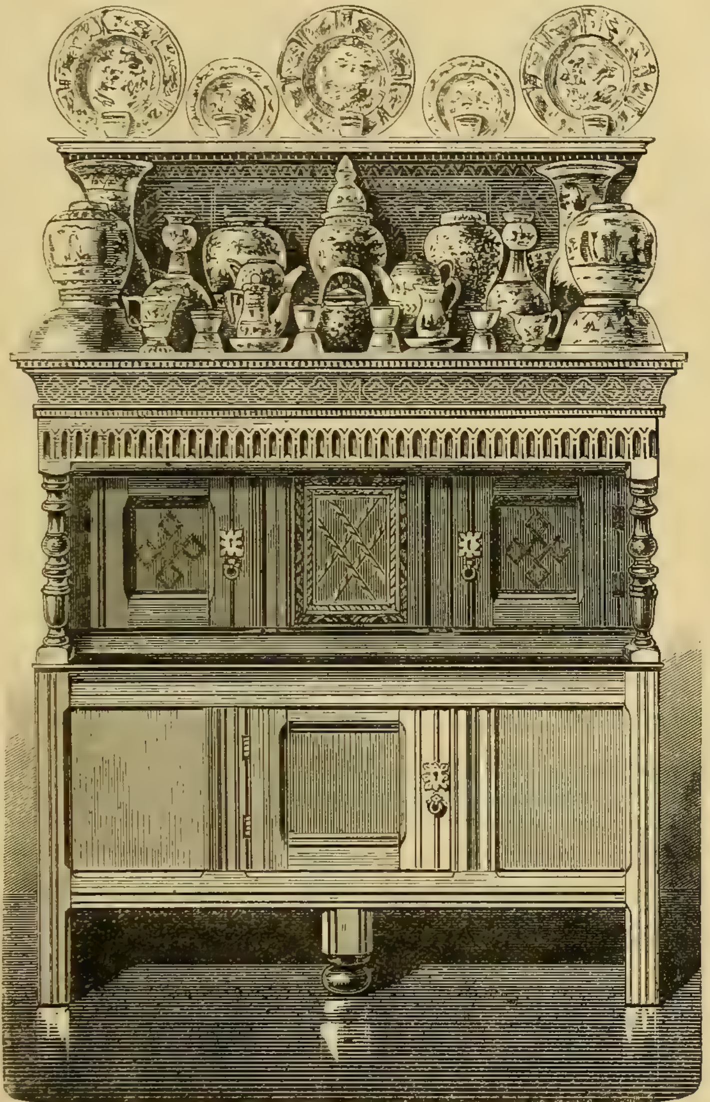


FIG. 1.—ELIZABETHAN CABINET, WITH OLD BLUE AND WHITE CHINA.

Many of my readers will have made pinewood cupboards, hat-stands, and other modern prosaics of a needful kind; but I am inclined to think that if once they grasp the idea of the old oak, almost old world, models which I shall endeavour to put before them, they will in future respectively almost abominate the one and love the other. And in order that I may, if possible, impress my readers with a little of the spirit which has attracted me so warmly to the artistic and skilful work of three centuries ago, I will ask leave to preface the technical portion of this article with a prologue on what is actually known of the influences which gradually led on step by step to the world-wide appreciation of our modern furniture, which universal demand has decreed, must carry the impress of art and beauty in combination with domestic conveniences. In the present day, when the cry the Eastern magician is heard again, and the wish to exchange the modern for the antique, the new for the old, is not confined to one here and there, but is widespread, little apology need be offered for calling attention to a subject which, though coming gradually to the front, is still somewhat neglected. In most countries, the possession of collections of antiques is looked upon as an indication, on the part of their owners, of education and refinement, but it may be questioned whether a critical business foresight and perhaps a princely fortune have not in reality oftener been the only handmaids in the accumulation of these treasures, though sometimes indeed they may have been of unique interest and the highest artistic importance; but whatever may now be the causes at work inducing lovers of ancient relics to possess themselves of these objects of their taste and fancy at almost any cost, and whatever may be the feelings with which these collectors are now regarded or the position accorded them in the educated world, it is certain that in a generation not very long past, they were more the subjects of merriment than esteem.

Albert Jacquemart in his valuable work on ancient furniture, glass, etc., lately translated and edited by Mrs. Bury Palliser, says, that "until within these last few years, those who devoted themselves to

researches after old furniture, antiquities, China, were looked upon as eccentric or mad, but the number of amateurs has increased, and the circle of objects collected has become extended ; yet Sir Walter Scott, himself a collector, sacrificed to prejudice in designating as innocent maniacs those who sought to discover in objects anciently in use, a history of man and of civilisation. It is therefore quite lately, thanks to the perseverance of art collectors, that ideas have modified, and taste by spreading has become enlightened. No longer bowing under a stupid irony, the *virtuosi* have made themselves the teachers of the people, and no one would now seriously dare to censure the amateur for collecting *babelots*."

Amongst the great variety of collections to which attention is called every day, not the least valuable are those of the curious and often highly-artistic furniture in oak of the sixteenth and seventeenth centuries ; but although to the uneducated eye one old oak cupboard looks much like another, there are few subjects which require greater care in the mastery of first principles.

Two pitfalls are always open and ready for the amateur, who is unacquainted with the true signs of the art : he is liable to be imposed upon by those who possess the power in which he is deficient ; and, on the other hand, he may often pass over and despise a genuine and valuable specimen, because its appearance is strange to him and bears to his untutored eye the appearance of a clumsy imitation, "but which often is only the mark of transitional work," and to the old collector an unfailing record of its real date and age.

The hand of time is, however, fast reducing through the agency of dry rot, the comparatively few specimens of good old oak furniture which are left, or likely to come within the reach of ordinary amateurs.

Genuine pieces, however, showing the chief characteristics of the work of those days, are to be met with, and although perhaps in beauty, in versatility of design the English is not equal to the contemporary work in other countries, nor as perfect in even the mechanical manipulation, yet there is a greater interest attaching to work, which carries us back to the days of our own ancestors, than in the most finished masterpieces of foreign artizans.

Collections of old furniture can hardly be expected to become very numerous. The size of the specimens, and hence the demand for many square feet of room for their accommodation, must inevitably handicap all enthusiasts who have not rooms of unusual capacity. Of old oak this is especially true, there being a determined bluffness and solidity about each piece which requires a more than ordinary amount of elbow room to counterbalance the undeniable heaviness which attends their particular style.

There is a peculiar interest attaching to the subject which is laid before us in the woodwork of two or three centuries ago, and, perhaps, as Mr. Bliss Sandars observes in his examples of carved oak woodwork : "There are few branches of art so interesting or instructive, either from a technical, historical, or social point of view, or which, from its intimate connection with the inner and domestic life of our ancestors, conveys so faithful an idea of their habits and customs. There is scarcely anything of a purely inanimate nature—possibly not even its literature—upon which the character of an age is so vividly impressed, as upon the homes of its people. It is by the houses of the past we instinctively appreciate and estimate the character and worth of the builder of bygone days ; and it is by the houses we are now building that the characters and feelings of the present generation will be estimated and judged by those who come after us. What is true of the houses is true, in a more particular sense, of the furniture, as being a more vivid reflection of our personal tastes and habits than even the houses in which we live."

And not only are we thus carried back to the days of our forefathers, and put face to face with their ideas of utility and convenience, but we are brought very near the early attempts in England at the artistic treatment of flat surfaces in wood, other than covering them with worked iron ; and in the often times rough delineation of both living and inanimate subjects, we are shown some of the difficulties which always beset a young art.

The study of old furniture is to all amateur workers in wood one of unfailing resource, and the pleasure derived does not stop when the beauty only it shows has been admired. It is history itself. By its examination we can trace with the greatest accuracy the changes in the habits of past generations—their growing requirements, their tastes and manners, altered from a time still earlier. The chests, caskets, cabinets, chairs, which have withstood the vicissitudes of time, carry us often in thought into other lands, and remind us of scenes of world-wide interest. "Some of these have held the bridal dresses, fans, and trinkets of French and Italian beauties, whose sons and daughters have long gone to the dust." Cupboards and presses, now black and decaying, but fresh and bright when Elizabeth came to the throne, remind us of stirring times in our own past. Boxes and chests, which formerly contained the title-deeds of estates, still survive, though the old land-owners have long ago passed away from their possessions. "Settles," which stood in chimney corners, and have heard many an

old English ballad sung by old English yeomen. Joint-stools, upon which the coffin was wont to be placed when death came at last, stand as they used to in out-of-the-way country corners, and are veritable bits of old England.

The early history of every nation is more or less wrapped in obscurity, and dependent on legends of varying degrees of improbability; but as a nation's requirements raised the demand for furniture, clear proof was afforded that it had really taken root and civilization was dawning. In their infancy nations are to a great extent nomadic, and as Jacquemart says: "The necessity of defence caused castles and fortresses to be erected, fitted for repelling and for protecting the humble dwellings which gathered round them; lords and vassals, rich and poor, providing against a victorious invasion, or the necessity of going to fight in distant parts for their country's cause, held themselves prepared to pack up in *chests*, kept ready for the purpose, all the articles composing their possessions. Chests are therefore the first and most ancient furniture. By degrees, as public security increased, and society, growing more condensed, found support in its legal organization, ease began to develope itself, and with it luxury, that innate want of intelligent races who require satisfaction of the eye in proportion to the enlightenment of the mind. Strictly speaking, then, it was not until after the strifes of the middle ages that furniture, such as we understand it in our day, could have existed; that is, an assemblage of objects placed in the principal divisions of the habitation to satisfy the different requirements, and present at the same time an agreeable, elegant, and even splendid appearance."

We can form a fairly good idea of the fashions and requirements of our ancestors as far back as Anglo-Saxon times, not because any actual specimens have survived the intervening nine hundred years between those early days and our own, but from illuminated missals of that date, which tell us something of the everyday life of the then inhabitants of England. Simplicity in those days reigned supreme. The Anglo-Saxon's house consisted, as a rule, of one room only, and in this single apartment stood the sole piece of furniture, a cumbrous table, which often, whether by design or its own weight, was immovable. This table was everything, for while off it they took their meals, on it they sought their rest, turning it at night into the bed, which, when occasion demanded, they shared with their guests, whose habits, of course, were as primitive as their host's. In more luxurious dwellings, a special, strong building seems, from the old pictures, to have been set apart as a sort of best bedroom for the mistress of the establishment; and apparently, when other materials were scarce, or, perhaps, when a little less fresh air than usual was desired, the bedstead, otherwise open overhead to the stars, was tiled in like the rest of the house.

When the Saxons in turn gave way to the Romans, Pollen tells us "that a new advance was made in luxury and refinement, such as it was of daily life. The houses began to grow, upper rooms, or rooms at the side of the great hall, were added, called solars (*solaria*), the sunny or light rooms, which seem to have been reserved for the ladies. In due time they added a "parlour," or talking room, a name derived from the rooms in which conversation was allowed in monasteries where silence was the general rule. Still the furniture was simple, and consisted of few objects. The table was on trestles, and the seats were benches. *Armaria*, armoires, cupboards, or presses, either stood in recesses in the wall, or were complete wooden enclosures. These had doors opening horizontally; the frames were not panelled, the doors were ledge doors of boards nailed to strong cross bars behind, and decorated with iron hinges and clamps beaten out into scrolls and other ornaments."

(*To be continued.*)

DRY-PLATE PHOTOGRAPHY.

By C. C. VEVERS.

X.—PHOTOGRAPHIC PRINTING—PRINTING PROCESSES—THEORY OF PRINTING, TONING AND FIXING—ALBUMENIZING—SENSITIZING—DRYING—FUMING.

IN the foregoing chapters the amateur has been instructed in the production of negatives only; thus far he has nothing but a glass picture, with the shades of nature reversed, to show as the fruits of his work. He has yet to learn how to make a *positive* copy of this glass picture upon paper, how to render the paper sensitive to light, and, after printing, insensitive; and, finally, as permanent as a photograph can be made.

Photographic printing is, or should be, a most interesting operation, but is apt to be very carelessly attended to by amateurs who, having made a good negative, think any further care in printing and finishing the picture unnecessary; or, if the negative be an indifferent one, do not understand that careful printing may produce a good photograph. As to the amateur who sends his negatives to the trade printer, I will say nothing; he is not worthy of being called a photographer, and he can never have the pleasure of pointing to a picture and saying he took and finished that himself. Everything that comes within the limits of an amateur's work, the amateur photographer

should do; the value of a photograph will be enhanced in his eyes by the amount of work and care it has caused him.

A negative, after being varnished and dried, is placed in a "printing frame" in contact with "sensitive paper," and is thus exposed to daylight until the paper has received a positive impression of the image on the negative. It is next washed, "toned," "fixed," again washed, dried, "trimmed," mounted, and finally "burnished" or "rolled."

A few years ago but one printing process was known; this was silver chloride printing upon "albumenized" paper. Now we have carbon, a process of printing in permanent pigments; platinotype, in which the salts of platinum take the place of silver; silver chloride and silver bromide emulsion prints. Each of these is more rapid than albumenized paper, the two latter processes requiring only a few minutes' exposure to gaslight. Carbon and silver chloride are capable of producing the warm tones resembling an albumen print; platinotype and bromide emulsion yield black tones only, and are very effective and artistic for views and some styles of portraiture. All have a dull matt surface, and lack, to a great extent, the depth and brilliancy observable in an albumen print, unless a highly glazed surface is given by "enamelling" each print before mounting. In all these processes the image produced is latent until *developed*, with the exception of platinotype, the image by this process being faintly visible when sufficiently printed; consequently, the printer has no positive method of knowing when the paper is sufficiently printed. These and other reasons, among which expense is a weighty one, have prevented the "quick processes" coming to the fore, and silver printing on albumenized paper is still the standard process.

Briefly and theoretically the process of printing on albumenized paper is this: One side of a fine close-textured paper is coated with albumen (white of egg being invariably employed) containing a certain proportion of sodium chloride ($Na\ Cl$—common salt), or ammonium chloride ($N\ H_4\ Cl$). When dry, the albumenized surface is floated upon a bath of nitrate of silver ($Ag\ NO_3$), which combines with the chloride, forming chloride of silver, and with the albumen forming albumenate of silver; there is also free nitrate of silver present in the paper. When dry, if the paper be exposed to white light, it gradually darkens, the light acting upon the chloride of silver, producing violet sub-chloride ($Ag_2\ Cl$) and liberating nitric acid, and upon the albumenate of silver forming a foxy-red sub-oxide ($Ag_2\ O$). The presence of the nitric acid which is set free, has the effect of making the printing process slower, and producing a less brilliant image. To neutralize the nitric acid, many operators "fume" the paper with ammonia previous to printing. When the acid is set free in printing, its action is counteracted by the ammonia; consequently, a brighter, richer, and quicker print is obtained. When the print is taken from the frame, it is washed in clean water to remove the free nitrate. It is next immersed in a solution of chloride of gold (gold trichloride—$Au\ Cl_3$), which "tones" the print by converting the sub-oxide into chlorine, and depositing the gold, of a purple colour, in a metallic state upon the image, taking the place of the silver removed. To make the print unalterable by the action of light, it is immersed in a solution of sodium thiosulphate, more commonly known as hyposulphite of soda, and abbreviated in photographic parlance to "hypo," which has the effect of converting the unreduced chloride of silver into hyposulphite of silver, which, being soluble in an excess of hypo, is dissolved out. This operation is spoken of as "fixation," and is similar to that employed for fixing negatives. Finally, the print is thoroughly washed in water to remove the hypo, which, unless perfectly eliminated, will cause the print to fade.

Now to treat the subject more practically. Paper with a fine even texture is specially made on the continent under two names—Rives and Saxe. Very little difference exists between them; perhaps for small work the former is the better of the two, while the Saxe, being a strong paper, is most suitable for large prints. It is supplied in sheets measuring about 22½ by 17½. If this paper were merely floated on a bath of salt, and afterwards sensitized, it would be spoken of as "plain" paper, which produces a grey and somewhat weak print with a dull surface. Formerly plain paper was much used for machinery, and similar purposes, but is being surpassed by the platinotype and bromide process.

To make albumenized paper, the whites of eggs are diluted with equal bulk of distilled water, and to each ounce of the liquid 10 grains of ammonium or sodium chloride are added; the whole is then well beaten with an egg-whisk, so as to liberate the albumen, which is enclosed in small membranous cells; the membranous shreds are then allowed to subside, and the clear liquid decanted off. Should it be desired to colour the albumenized paper, a very small quantity of liquid analine of the required tint is now added to the albumen. For views, etc., only white paper should be employed; but for portraits a pink tint often improves the picture. The paper is finally floated upon the solution for about a minute, hung up to drain and dry, and is then ready for sensitizing.

The process of albumenizing paper is a tedious and messy one, and when done on a small scale is

rarely attended with the best results. There are several large firms who prepare albumenized paper, and sell it much cheaper and of better quality than the amateur could make it; therefore, I would recommend my readers to purchase their paper ready albumenized. It is sold in several tints, and generally in two qualities—single and double albumenized.

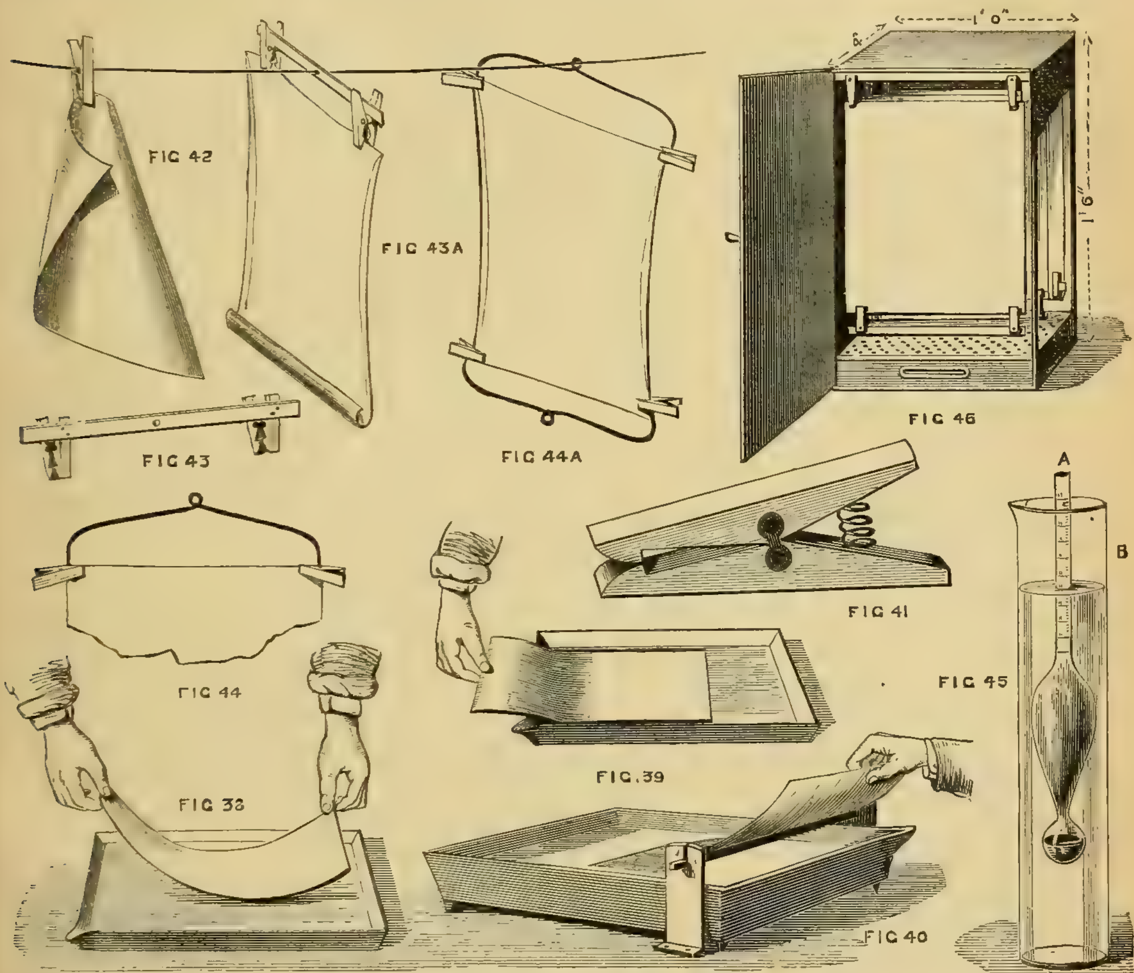


FIG. 38.—LAYING ALBUMENIZED PAPER IN SOLUTION. FIG. 39.—DRAWING PAPER OVER EDGE OF BATH. FIG. 40.—DRAWING PAPER OVER GLASS ROD. FIG. 41.—WOODEN CLIP. FIG. 42.—SUSPENSION OF PAPER ON WIRE BY CLIP. FIGS. 43, 43A, 44, 44A.—SUSPENSION BY STRIPS OF WOOD OR WIRE. FIG. 45.—ARGENTOMETER. FIG. 46.—FUMING APPARATUS.

The latter has a finer gloss, and produces slightly richer prints; but it is much more difficult to work, and is very liable to "blister," a defect which will be explained in due course.

The following articles will be required for preparing sensitizing paper :—

1 quire Albumenized paper, 6s.; 11 in. by 9 in. Shallow porcelain dish, 1s. 8d.; Argentometer and tube, 2s. 6d.; 2 ozs. Nitrate of silver, recrystallized, 7s.; Ebonite forceps, 10d.; from 6 to 12 American clips, 9d. per doz.; Filter paper, 1s.; Fuming box and ammonia.

The albumenized paper can be purchased at any dealer's. I cannot particularize any one make, but any of the following brands may be relied upon : Trapp's, Marion's, Ridgway's, "S. S.," "Three Stars," "Cross Swords," or Elliott and Fry's. The paper should be stored *flat* in a cool place—heat encourages blisters and cracks. It will be better, also, to keep a small quantity in an actually damp place for several hours before sensitizing. When damp it floats better on the solution, and is not so liable to blister. It will take up less room if the sheets are each cut into four, if an 11 inches by 9 inches dish is used for sensitizing, or in two, if the

amateur prefers to use a larger dish and more solution. Trade sensitizers, and a few professionals, float a whole sheet at a time; but in addition to the expense of large dishes and solutions, considerably more skill is required in manipulating a large sheet. The paper should be cut on a flat table, covered with a sheet of clean paper; great care must be observed that the albumenized surface is not cracked or scratched. The sheet is laid, albumen side down, on the table; the hands must be clean and dry, and an ivory paper-knife should be employed; the sheet is folded in two, and cut with as clean edges as possible. The paper-knife should not come in contact with the albumen when cutting, or it is almost sure to scratch the gloss; to prevent this, the paper should be folded albumen side outwards. Each of the two pieces are again cut in two; the quarter sheets should then measure about 11 inches by 8½ inches.

The silver bath is then prepared. Perhaps no other solution employed in photography is used in such a variety of strengths. Some operators use a bath containing only 30 grains of silver to each ounce of water; others use one containing as much as 70 grains, and sometimes more to the ounce. Different brands of paper require different strengths; cold weather necessitates a strong bath, hot, a weak one. A strong negative, with plenty of contrast, should be printed on paper from a weak bath; while a flat, weak negative will require plenty of silver to get the best results. Of course, altering the bath to suit every degree of density and strength of an amateur's negatives, would be out of the question, so it is advisable to use a bath of average strength; this I find to be about 50 grains to the ounce of water. In summer time it can, with advantage, be reduced to 45 grains, and in cold weather increased to 55 grains.

Sufficient solution should be made to fill the dish from ⅜ inch to ½ inch deep. From 15 to 20 ounces will be sufficient to float on quarter sheet, so that the bath may be made as follows:—

Sensitizing Bath.

Nitrate of silver	2 oz. (avoir.)
Distilled water	17½ oz.

The bath must be carefully tested with litmus paper, and made slightly alkaline by the addition of dilute ammonia or bicarbonate of soda. The solution must be frequently tested and never used if acid, otherwise the bath will rapidly discolour and poor prints will result. The strength of the solution is next proved by means of an argentometer— a modification of the hydrometer. This instrument, illustrated in Fig. 45, consists of a float, A, with graduated stem, and a glass tube or jar, B, wide enough to admit the float. The jar is about half filled with the sensitizing bath, and the float immersed in the liquid in which it will sink according to the specific gravity of the solution, the numbers on the stem opposite the surface of the solution denoting the precise amount of silver in each ounce, or sufficiently near for all practical purposes, the argentometer, of course, including in the specified strength any other salts that may be dissolved in the solution.

When paper is floated on the solution, the bath is reduced in bulk and also in strength. The quantity of solution should never be less than 15 ozs. for a quarter sheet, and the bath should be maintained at the standard strength (50 grs.) as closely as possible, by being frequently tested (say, after sensitizing every half dozen sheets) with the argentometer, and, when required, strengthened by the addition of a strong solution of silver, say 100 grs. to the oz. until the float indicates the desired strength.

I must not omit to remind the beginner that he should be careful when using the silver bath that the solution is not splashed or messed about, or his bad manipulation will be quickly shown by the colour of his fingers and clothing. Always keep the bottle containing the solution in as strong a light as possible when not in use, the light precipitates any impurities that may be contained in the solution, which can then be filtered out.

The 11 × 9 dish must be used for no other purpose than sensitizing paper; it must be kept perfectly clean and away from other chemicals, as the least impurity often disables the solution. The whole of the operations may be conducted in gaslight, and if desired, the sensitizing may be done in daylight, but the paper must not on any account be exposed to white light, after being removed from the silver bath until it is exposed through the negative in printing.

The dish is levelled on the bench, the longest sides opposite the operator. The solution is poured from the bottle down the side of the dish, so that no air bubbles arise to the surface when in the dish. Next, a strip of tissue paper 2 or 3 inches wide and almost the length of the bath, is laid on the solution at the side nearest the operator, and drawn across the solution and over the opposite edge of the dish; this will remove any dirt that may be floating on the solution, and which would otherwise attach itself to the first sheet of paper floated. A piece of albumenized paper is taken by opposite corners, glazed side downwards, between the finger and thumb of each hand (Fig. 38), the centre of the sheet is gently laid on the surface of the bath and the corners are slowly lowered until the whole of the sheet is floating on the solution; if this is not done very steadily, the solution will run over the back of the paper. The ebonite forceps are taken up and one-half of the paper is lifted back-

wards from the bath, so that the albumenized side may be examined; should any air-bubbles be clinging to the paper, they must be broken by blowing or with the tip of the forceps or anything clean, that will not scratch the albumen; the sheet is again lowered on to the solution and the opposite side examined in the same manner. Unless the paper be damp at the time of floating, the edges will probably curl up, but they will gradually fall back to the solution, or they can be hastened by gently breathing on the back.

After remaining in the bath from two to three minutes the right hand end of the paper is raised by means of the forceps, and the sheet slowly drawn over the edge of the bath, which must be clean and smooth (Fig. 39). If the dish has a rough uneven edge, a glass-rod should be fixed near the right end of the dish over which to draw the paper, as shown in Fig. 40. Most porcelain dishes have a round, smooth edge, and a glass rod will not be required unless the edge has been snipped. By this procedure the surplus solution is drained from the paper, which would otherwise be wasted when the paper is suspended to dry.

The paper is now held by one corner, between the left finger and thumb, and is made to curl with the wet surface outwards, by gently tapping the back of the sheet. It is now suspended by means of a wooden clip (Fig. 41) to a cord stretched across the room (Fig. 42), and, should any of the solution be on the paper a small piece of blotting paper may be attached to the lower corner of the sheet, to absorb the drippings and prevent the silver falling on the floor. The beginner may find some difficulty in preventing the paper curling inwards and adhering together when dry; he can prevent its curling by using two clips attached by means of a strip of wood (Fig. 43, 43A), or wire (Fig. 44). If the lower portion of the sheet still curls, he can attach another of these "twin" clips to the bottom of the paper. In the absence of American clips bent pins may be employed, but I do not recommend their use, as they are liable to tear through the paper and allow it to drop to the ground, besides spoiling one corner of the sheet, by puncturing a hole through it. When one sheet has been suspended another may be floated on the bath, and the operation repeated until the required quantity has been sensitized, when the solution is returned to the bottle through the filter paper, and the dish well washed and put on one side. The paper will dry in a temperature of 60° or 65° in from one to two hours; if required at once it may be dried before a fire, but this is not advisable.

When dry, the paper can be printed from at any time, but if fumed with ammonia it will yield quicker and more vigorous prints. The paper should not be fumed until it is required for printing.

Unless prepared with a "preservative," the sensitized paper rapidly discolours, and this yellow discolouration cannot be perfectly removed in any of the after operations. Should it be desired to keep the paper more than a day or two, the sheets should be laid flat in a book, composed of leaves of white blotting paper, which have been immersed in a saturated solution of carbonate of soda (washing soda) and dried. In this manner the sensitized paper may be preserved white for three weeks or a month, specially if well pressed the whole of the time.

The apparatus required for fuming consists of an ordinary wood or tin box or cupboard, measuring about 18 in. by 12 in. by 4 in., and opening at the front, as shown in Fig. 46. A false bottom, perforated with ¼ inch holes, is fixed 2 in. or 3 in. from the bottom; under this false bottom a dish or other vessel containing a small quantity of liquor ammonia is placed. The sensitized paper is suspended in the box by means of the twin clips which rest on a strip of wood, running along each side of the box near the top. Any number of sheets may be fumed at the same time, the box described is large enough to take three or four quarter sheets.

The box may be fastened to the wall or stand on a bench or table; the lid should be made to fit tight, so that when shut the ammonia fumes are retained in box. The paper to be fumed is suspended on the strips, the ammonia is placed under the perforated bottom and the door closed. The paper is allowed to remain in the fuming box for ten or fifteen minutes, when it is removed to a drawer or other light-tight place till required for printing.

(*To be continued.*)

THE VIOLONCELLO:

HOW IT MAY BE MADE.

By A. H. SMITH.

BEFORE the construction of this instrument is attempted, I would suggest that the amateur should have some practical knowledge of how to construct the violin. His hand will then be accustomed to the kind of wood he has to deal with, and the manner of working it. If one has failed in the practical part of the construction of a violin, he need not trouble about 'cello-making. The work is much heavier, more awkward in managing, and requires more patience from the beginner.

Perhaps many have constructed violins after the excellent methods shown by Mr. Allen in previous volumes, and are ambitious to try their skill upon the bass instrument. To these, especially, I hope the

following suggestions will be of service. To others, taken in conjunction with Mr. Allen's articles, the remarks will be of equal service, as in only a few particulars does the construction of the violoncello differ from that of the violin.

The Violoncello.—The tone of a violoncello is an octave and a fifth below that of a violin, and, in order to produce the fundamental tone, must, according to Savart, have a capacity to contain air, which will sound a note equivalent to 170·66 vibrations. To increase the violoncello proportionally with the violin would give a very clumsy and unwieldy instrument of about 35 or 36 inches long, by 20 or 21 inches in breadth. To obtain the proper capacity, and to bring it within a reasonable size, it is shortened and deepened; and the length of a full-sized 'cello by Stradivarius (see page 432, Vol. I., of AMATEUR WORK) is given by Mr. Allen in round numbers—as 29 inches, the breadth 18 inches, and instead of being about 3 inches high the sides are made a little over 4½ inches in height. These differences in the sides counteract the shortening of the tables.

The Material.—The best material to use in the construction of the 'cello is identical with that of the violin; and the same remarks apply to its cutting, cleanness, and freedom from flaws, marking and seasoning. All blemishes should be rigidly avoided. Pear-tree, lemon-tree, beech and ash, among others, have been used for the violoncello, and these woods were in common use among the early Brescian makers. None of them, however, can approach the sycamore for the marking of the wood. Beech is rather to be avoided, as it is one of the most wormy woods that could be well met with. This *worminess* might be stopped, or at any rate lessened, by using cedar linings and blocks; but, after all, nothing can be better than the maple; and there is no use throwing away one's time and skill over imperfect material. One may, however, try his 'prentice hand on beech or pear-tree if he can procure it, suitable in cutting, grain, and seasoning.

The price for a maple back at the instrument maker's is expensive, running up as high as 50s. and 60s.; and the pine belly may cost from 15s. to 30s.; and the ribs from 5s. to 15s. Go to a reliable dealer or maker, and you will not regret it after your instrument is finished. The London Directory shows several who may be depended on, if you can induce them to part with wood even at any price. Be careful in the choice; see that it is large enough, especially the ribs or sides, as one may get material for a smaller-sized instrument than was intended. If it is not convenient to spend so large an amount upon raw material at first, procure a well-seasoned plank of Scotch plane about 31 inches by 9 inches by 3 inches, with straight grain, saw it down the middle so as to leave the wood in two pieces 31 inches by 9 inches, and 1½ inches thick, and join in the way described by Mr. Allen for the violin. Or it might be procured from the places where wood most doth congregate, and by watching one's opportunity and getting it properly cut, it may be of advantage. But there is great difficulty in procuring wood for 'cellos *by chance.* A man might look about for it on that footing for a decade and not find any. Unless, therefore, the amateur has some wood, either for back, front, or sides, he had better purchase it according to the length of his purse.

The Tools.—The Callipers will do if they are of the shape at Fig. 13, Vol. I., page 231. I used the ones I bought for violin-making, and they were large enough; although if one were ordering them it might be noted that length of arms to take in 9 or 10 inches would be a convenience. The larger callipers would be quite as serviceable for violin-making; or callipers shaped like the figure 8 could be used, but they are not so handy or so accurate as the ones first mentioned; 8s. 6d. will be the cost of either. They may be had from Mr. Hill, in *Wardour Street.*

A Socket Gouge will be required. This ought to have the cutting edge outside the curve, which should be in breadth about 1 or 1¼ inches. It has a socket instead of a tang at the other end, into which a broom-stick 3 feet in length can be inserted. This weapon gives tremendous purchase, and the blocking out of back and front can be done with it after being sawn into shape with the bow saw. It costs about 2s.

The Cramps.—About twenty cramps will be required, sufficient to take in 5½ inches in the bite. The double ones are the best, as the ordinary single screws with nuts are always knocked off at the wrong time. Half-a-dozen single screws for close spaces might be of great service, however. If the amateur has among his tools a ½ inch screw tap and die, he can easily make the cramps for himself out of a few ½ inch beech or hard wood rods. A past-mending beechwood bedroom chair comes in handy for this work, the ornamental parts making useful tool handles besides.

The Mould.—This is better to be an inside or French mould, as described by Mr. Allen in constructing the Guarnerius Violin, in Part 39 of AMATEUR WORK; but it is of larger dimension, of course. After considering and procuring the necessary form for outline, cut another a quarter of an inch less than the finished outline all round, and from this the mould may be traced. Zinc is the best material for the outlines, as it lies best and is easily cut with a pair of large shears or even ordinary scissors. Procure two planks of 1½ inch common deal wood 18 inches broad

if possible, and 30 inches long, or if wood 18 inches broad cannot be procured "joint" them to make up the breadth necessary for mould. Take the two pieces of wood and screw them together, and after finding the centre line, trace the outline of the mould carefully on the cleanest side and send the result to the band-sawyer, if he is at hand; or do the sawing with the bow saw, and plane the sides or edges of the mould until they are perfectly perpendicular, using the square constantly. If the work is sent to the sawyer, instruct him to save the outside pieces, or what he will call waste, as they are useful for the cramping-blocks, if you use cramping-blocks. Some do not find them necessary, but use merely a semi-circular piece of wood at the abrupt curves of the bouts, bending the sides carefully to fit the mould. One inch holes are bored in each plate convenient for fixing the ribs to the mould with iron cramps. Two at top and bottom, and one at each corner block, on both sides of the mould—that is, above and below—are necessary.

If you do the work yourself, above all things keep the sides perfectly perpendicular and at right angles to the plane of the mould, following the outline carefully, because on this correctness depends, to a great extent, the beauty of your finished work. A 'cello with the sides at different angles, and with an air of uncertainty about them, must needs be a woe-begone object at the best. Cut out the spaces for the blocks at the corners and the top and bottom. If the corner spaces are cut out about an inch long and deep, and the top and bottom spaces about 3 inches broad by $1\frac{1}{4}$ inches deep, it will be ample.

After this work has been accomplished to your satisfaction *and that of the square* separate the plates, cut two bits of inch wood so as to lie from side to side across the upper and lower bouts. Screw them to one of the moulds, and then screw the other plate to these bits of wood, keeping the sides of both plates perpendicular and not overlapping in any way. The bench vice or large cramps come in handy here. The whole will then form a 'cello mould 4 inches in depth with a space of 1 inch between the two plates. The holes for the cramping-irons above mentioned can now be bored, or suitably placed if cramping-blocks are used. The corner blocks can then be glued in, and the outline being traced on them, cut, and the work of building in the ribs proceeded with exactly as in violin-making; but, of course, the blocks will have to rise above the mould according to the height of the model used. The dimensions are given in Vol. I. AMATEUR WORK, page 432.

The other tools required are merely those pointed out by Mr. Allen, and those usually in the carpenter's shop.

Construction.—The ribs should be not less than $\frac{1}{16}$ of an inch in thickness when fitted to the mould. They may be bent as easily as violin ribs over a brass (1 inch) tube 6 inches long, with iron beaters to fit—the tube being brazed to a heavy stand; or an Italian iron about six inches long, if procurable, may be used. Be careful to avoid buckling, as the dimensions of the ribs are very conducive to this unsightliness. Don't press on the wood while bending until the wood is thoroughly heated through and the damp cloth above is steaming. With care, there is no fear of the wood splitting, unless it is very ornamental, when it often will in the most experienced hands.

Proceed with the cutting of the tables exactly as described in violin-making, leaving the thicknesses as follows:—The back at the thickest part $\frac{3}{8}$ inch, decreasing gradually to $\frac{1}{4}$ inch, and all round $\frac{3}{16}$ of an inch in thickness; the front a little over $\frac{1}{4}$ inch, decreasing to $\frac{3}{16}$ inch, and all round a little over $\frac{1}{8}$ of an inch; the thickness of the borders of the two plates may be about $\frac{1}{4}$ of an inch, or a tiny bit less. Anyone looking at the diagrams given in pages 405, 409, and 468, Vol. II., of AMATEUR WORK, will understand the mode of applying the above measurements. I might mention here that the moulding of the tables in a 'cello are not generally so bold in the curves as in a violin; and they need not rise more than an inch at the highest, even if so much. The bass bar 20 inches long, $\frac{3}{4}$ inch deep at notch of *f f* holes, and $\frac{5}{16}$ inch broad.

The *f f* holes are traced in the usual way, but the circles can be cut with a brace and bit of the requisite size, instead of using *f f* hole punches; but the bits must be sharp.

The following are additional dimensions:—Neck, from chin of scroll to base of button, 11 inches; length of fingerboard, 1 foot $10\frac{1}{4}$ inches; length of peg-box (inside measurement) $1\frac{1}{2}$ inches; breadth at narrowest part (inside measurement), $1\frac{1}{8}$ inches.

The bass bar should be fixed so as to be directly under the left foot of the bridge, sloping gradually to the head of the instrument, in a line with the strings.

The indenting or purfling is a little wider than that used in violin construction, and can easily be purchased. A tool used for cutting rebates in picture-frames, often given with sets of fret-tools, is as good a tool for cutting the lines for the purfling as one could get; it costs 1s. 6d. The cutter requires to be well sharpened before use.

The curl of the head is copied as instructed by Mr. Allen for the violin; but, of course, the dimensions differ. A good head and neck may be purchased, costing from 6s. to 15s., including pegs. Avoid machine heads, they are nuisances; unless, perhaps, the instrument be intended for a lady.

I think there is sufficient information in the foregoing to enable any person who has constructed a violin, and read carefully the interesting papers on violin-making which have appeared in this magazine, to finish a 'cello. I would have been happy to have furnished a tracing of body, patterns, and head ; but the dimensions of the sheet of patterns, which would be about the size of an ordinary newspaper, would make too large a Supplement or Folding Sheet for this magazine. But any music-seller would furnish a paper tracing of the outline, both of body and *f f* holes, and allow measurements of any 'cello in his possession for a small fee. I got mine for my first 'cello for 6d.; and a friend took his pattern from a very good one which was exposed for sale in an auction-room. I might mention here that the 'cellos which are sold in the shops for from £6 to £10 are very good, and there need be no compunction in taking an outline from them.

Apropos of the varnish, I would caution the maker not to use a very highly coloured one. A 'cello with a vermilion coloured varnish bears vulgarity of a very pronounced type upon its flaming face. Of course, the varnish should be an oil one, and the colour should be in the varnish, not stained into the wood of the instrument.

THE TRAVERSING BAR:

A SUBSTITUTE FOR THE TRAVERSING MANDREL.

By F. A. M.

TO cut screws is beyond all question one of the greatest objects of ambition to young turners, and rightly so. Once let the tools for hand turning be properly mastered, the next and most useful thing to acquire is the power of cutting screws.

There is such great variety in the form of screws, and so many different materials are used to make them, that it is not wonderful if many different methods are employed in their production. For example, we have the screws and bolts, with their nuts, used to unite parts of machinery ; screws of several diameters in length, and oftenest made of iron or steel. Such screws are seldom made in the lathe by amateurs, though manufacturers use specially constructed lathes for making them in quantities. These screws will be made by the "stock and dies," and the nut threaded by the corresponding "tap." Again, a long wooden screw, such as that of the carpenter's bench, or those of his gluing cramps, would best be made by the "screw-box," which corresponds to the "stock and dies" for metal, and the nut would be threaded with a "tap" as before.

Coming now to lathe-cut screws, we find they are of two kinds. There are first *long* screws, used to move the slides of rests, or to move the slide-rest along the bed, as in a slide-lathe, and become the parent of other screws. Such screws as these could not be properly cut by the "stock and dies," because, even if they were not too large, they require to be very exact in the pitch, that is to say, they must have exactly the same distance between the threads, so that a number of threads taken at one part of the screw shall occupy exactly the same space as the same number of threads taken at any other part of the screw : a result which cannot be attained by the "stock and dies," but only by the slide-lathe, with its long pattern screw of equable pitch.

The slide and screw-cutting lathe, with its leading screw, is the prince of tools for cutting screws. It will cut them short and long, small and large, inside or out, and, with twenty-two change wheels, it will cut them with almost every rate of pitch the amateur *thinks* he wants, and vastly more than he will ever really require.

In spite of all that has been said for the slide-lathe, it is not very convenient for the numberless *short* screws required by the turner in wood to unite his boxes, screw together his candlesticks, or other works in wood or ivory, which, for convenience, he will make in parts. The slide-lathe takes too long to arrange, and cannot be driven fast enough for wood. It is perfect as an engineer's tool, for working in iron and brass ; but for wood and ivory, and small brass optical work, etc., something much lighter and more expeditious is required, and that something is found in the Traversing Mandrel.

The traversing mandrel is an old and well-known device. It is also a very perfect one within its own particular range, which is the production of short screws of wood, ivory, or brass, which require a fair rate of speed, on work *which does not require the support of the back centre.* Here we put our finger on its weak point. The traversing mandrel has parallel necks, not conical. Its parallel necks turn in parallel collars, which are about an inch shorter than the necks, so that it can not only turn, but at the same time slide, or traverse forth and back, in its collars. This mandrel carries upon it one of several ferrules, on which are cut screw threads. Corresponding portions of fixed threads can be brought into contact with these screwed ferrules when desired, and then, the mandrel having also been released, it screws itself forward as it turns, carrying the work with it in such a way that a point tool (or comb-screwing tool, otherwise called a chaser) will cut upon the work a

thread of similar pitch to that of the screw ferrule forming the guide. Thus it becomes evident why the back-centre cannot be used except when made with a spring, so as to recede as the work advances, and follow it up as it returns.

The traversing mandrel is, however, an expensive tool; and, perhaps, more than anything of the kind, difficult to construct successfully. Probably no amateur would succeed in making one of hard steel, with hard steel collars. Besides this, if a headstock be fitted with a new mandrel, every chuck will be thrown slightly out of truth, which is a serious matter when there are many of them, and when some are expensive ones.

Having said so much about screw-cutting in general, and about the traversing mandrel in particular, it will not be so difficult to describe the traversing bar. This is an original device which the writer has made for his own use, and which proves very convenient: it was contrived to carry out a suggestion by Mr. Lukin, who is already well known to the readers of this Magazine. Most of the appliance is easy to construct, and the whole arrangement has two considerable advantages over the traversing mandrel—namely, that it can be applied to any lathe and any mandrel, and it can be used in connection with the back-centre. If, then, a turner has a good lathe with non-traversing mandrel, to which a good many favourite chucks are fitted, and if he does not wish to disturb the truth of his chucks or go to the expense of a traversing mandrel, and yet wishes to be able to cut short screws in wood, ivory, and brass, the traversing bar will meet his need.

I come now to the descriptions of the illustrations. Fig. 1 is the elevation, showing a pair of 4 inch centre headstocks and hand-rest on a double V bed, the traversing bar appearing in front, and marked in this and the other diagrams B. Fig. 2 is the plan, and Fig. 3 the end view. The bar B lies in the brackets A and C, Figs. 1 and 2; it is ½ inch in diameter, and must be of steel, or it will bend too much. It must be carefully and smoothly finished, so that it can slide in the holes in the brackets A and C without any looseness; probably about two feet or two feet six inches of rolled Bessemer steel would do, as a straight piece could be chosen, and it would then need no turning. A flat, about ¼ inch wide, is filed along the bar, as seen in the three views. The screw guides are shown cut upon a sleeve fitted upon the mandrel. In a new lathe they might be cut upon the mandrel itself. If the mandrel have a seat for change wheels, the ferrules may be fitted there; but if neither of these plans are available, the ferrules may be fitted upon the chucks as shown at Figs. 4, 5, and 6, where the bosses of the chucks are all turned slightly conical, and the ferrules carefully fitted to the same cone by boring out and then grinding them on a wrought iron grinder turned to the same angle as the chucks. If this is carefully done they only require firmly pressing upon the chuck boss with the hand. The screwed part of these guides is ½ inch long; but it would not do to make the ferrules only ½ inch wide, as at Fig. 5, because they would be liable to get slightly askew upon the chuck boss; this would be quite fatal to good work, as it would cause the thread to be "drunken;" but more of that anon. At Fig. 4 is seen a ferrule 1 inch long fitted upon the square hole chuck, and this is long enough to prevent its getting askew by being pushed on harder one side than the other.

At Figs. 1 and 2 is seen a back centre mandrel rather longer than usual, but not too long; they are unfortunately often made too short. Here it is supposed that the pulley has been pushed up as close to the frame as possible, and room has been made for three threads cut upon a sleeve, seen in position at D. If room cannot be found for three, an amateur workman might well be content with two, since others could at any rate, be added as ferrules to go upon the chuck bosses. If only one pattern screw could be put upon the mandrel, it would be well to put that one there, and leave the others to go on the chucks. The most useful number of threads is, perhaps, 20 to the inch; if two threads can be obtained, then, perhaps, 20 and 12. The screw ferrules being the patterns, must be accurately cut, and this will require a slide-lathe. The ferrules must be bored and fitted first, then driven upon a conical mandrel to be screwed, and this part the amateur is advised to have done for him.

The motion from the guiding thread must now be conveyed to the traversing bar, that the bar in its turn may convey it to the chaser. This is done by means of the arm E in Figs. 1, 2, and 7. It is quite a simple forging; it requires to be bored with a ½ inch hole, so that it can go upon the bar, to have a thumb-screw fitted to fix it rather firmly, that it may neither slide nor turn upon the bar, and to have an oblong hole drilled and filed out at its other end, to take some wooden dies seen at E, Figs. 1, 2, 7, and 8. These wooden dies, or half-nuts, receive the motion from the screw ferrules, and there must be one to each thread. The oblong hole in E is not filed out parallel sideways, but is larger at the bottom, so that the wooden dies can be pressed in tightly even if they shrink a little (see Fig. 8). The dies should not embrace more than one-quarter of the circumference, or the action of the screw ferrules on their sides will tend to lift the arm. The threads in the dies were formed by making duplicates of the screw ferrules of iron, and filing across the duplicates as seen at Figs. 5 and 6, the arm E being brought opposite the

chuck holding the duplicate screw ; a blank die begin fitted into the slot and rounded out approximately, the die in the arm was pressed down upon the roughened screw, which then acted like a hub, and the thread was formed with only a few turns of the wheel. It will now be understood that if the arm E, containing a die, be gently pressed down upon the corresponding guide-screw whilst the fly-wheel of the lathe be swung half round and back, the traversing bar will be moved to and fro, endways, by the revolving screw-guide and the arm E. It only remains to communicate that motion to the chaser.

In Figs. 1, 2, and 3, is seen upon the middle of the bar a brass casting F ; this is bored through with a ½ inch hole to go on the bar, and across its flat top is filed an undercut wide groove, in which slides a flat iron plate G. The groove is filed to such a depth that it cuts into the ½ inch hole to the depth of the flat on the bar, best seen in Fig. 3, so that when the thumb-screw of F is fixed, it thrusts forward the bar and clamps both it and the flat guide G. The slot is undercut and made long because it is quite essential that G should have no side shake whatever.

There is an opportunity for a little nice fitting in the pieces F and G. The object to be attained is that the parts should be so put together that if E be held down on a screw with one hand, and the front end of G be taken in the fingers, it should be impossible to move it sideways upon the rest, but that the end of G should move as if rigidly fixed to the wooden die, the two thumbscrews being screwed home. There must therefore be no shake in any of the joints, but the traversing bar and its two arms must move as one piece ; neither must it be too weak, or it would bend ; nor must it slide too loosely in the carrying brackets. These brackets A and C are shown again separately at Fig. 9 ; A is screwed into a ticklish place in the headstock, where one does not like to weaken it with a hole ; the screw is ⅜ inch. Most headstocks would stand a hole of this size ; but if it be a valuable tool, or if it looks weak, the bracket A may be made to clasp it. A is not in the way, and does not require to be removed ; the shoulder of the ⅜ inch screw must be eased away till the boss of A comes upright when screwed home. C may be fitted in the same way, or as shown in Fig. 9 ; it will require to be removed sometimes, but that is easily done. These brackets must be so adjusted that the traversing bar shall be fairly parallel with the lathe centres ; their necks below the bosses are ⅜ inch square, and they can be bent a little to get the position of the holes exactly right. The boss of C is cut down into the hole with the hack-saw, as seen at Fig. 9 ; this makes it very easy to place the bar in position. It would not do at all to cut down the other bracket in the same way.

We will now proceed to cut a screw ; and, since the peculiar advantage we have with the bar over the mandrel is that we can operate upon the end of a long piece of work supported by the back centre, let us suppose that we have just turned a cylinder such as that seen in the drawing, and wish to cut a screw upon its further end. First, then, supposing the bracket C to be in position, take the bar, with its two arms, off the nail where it hangs by the lathe ; lay one end in C and slide the other end into A ; choose a wooden die and press it firmly into E, and then rest it on its corresponding thread on the mandrel or on the chuck. Now lower the rest (and you must have one that will go a quarter inch below the centre), loosen the thumbscrew of F, and slide F on the bar and G in F till they take up the position shown in the drawing. Press down E till the threads of the wooden die engage with those of the screw guide ; raise G a trifle from the rest, and clamp the screw of F. Now if you bear on the end of G it should go down on to the rest, owing to the elasticity of the bar. If, while bearing down G, you try to lift E out of gear, you will not be able ; in fact, matters must be so arranged that while G is held down on the rest, E cannot rise a hair's breadth, and yet G must come down low enough to touch the rest. Now take up the chaser, which corresponds to the guide-screw and die, and lay it on G, as seen in Fig. 3, with its side resting against the little peg, and the weight of your hands and the chaser holding G down (and therefore E down). Now give the fly-wheel a swinging motion half round and back, and you will see the chaser travel to right and left along the rest ; and you have only to approach it into cut, and it will cut you a true thread. As soon, however, as you have a clearly-defined thread, it is as well to take out the bar and finish it to full depth with the chaser on the rest.

An inside thread is as easily cut, but here the guide G is pulled out further, and works to and fro in front of the lip or edge you wish to screw ; whilst the chaser lies across the end of G, and is held to it firmly with the fingers. It is well to put a little oil under G, that it may slide freely on the rest ; also under the chaser when using it upon the rest. A chaser must move freely, and a smooth-topped rest should always be used, as if it were to catch or drag, the thread would be spoiled.

Almost all turners can use the chaser "flying," that is, they catch the knack of moving the chaser at the right speed, so that they can cut screws by hand with no assistance at all. These threads are sometimes very fair, but are never perfectly free from drunkenness except by chance. The effect of this serious fault is that a box lid, for instance, does not go up evenly all round, but comes up on one side before

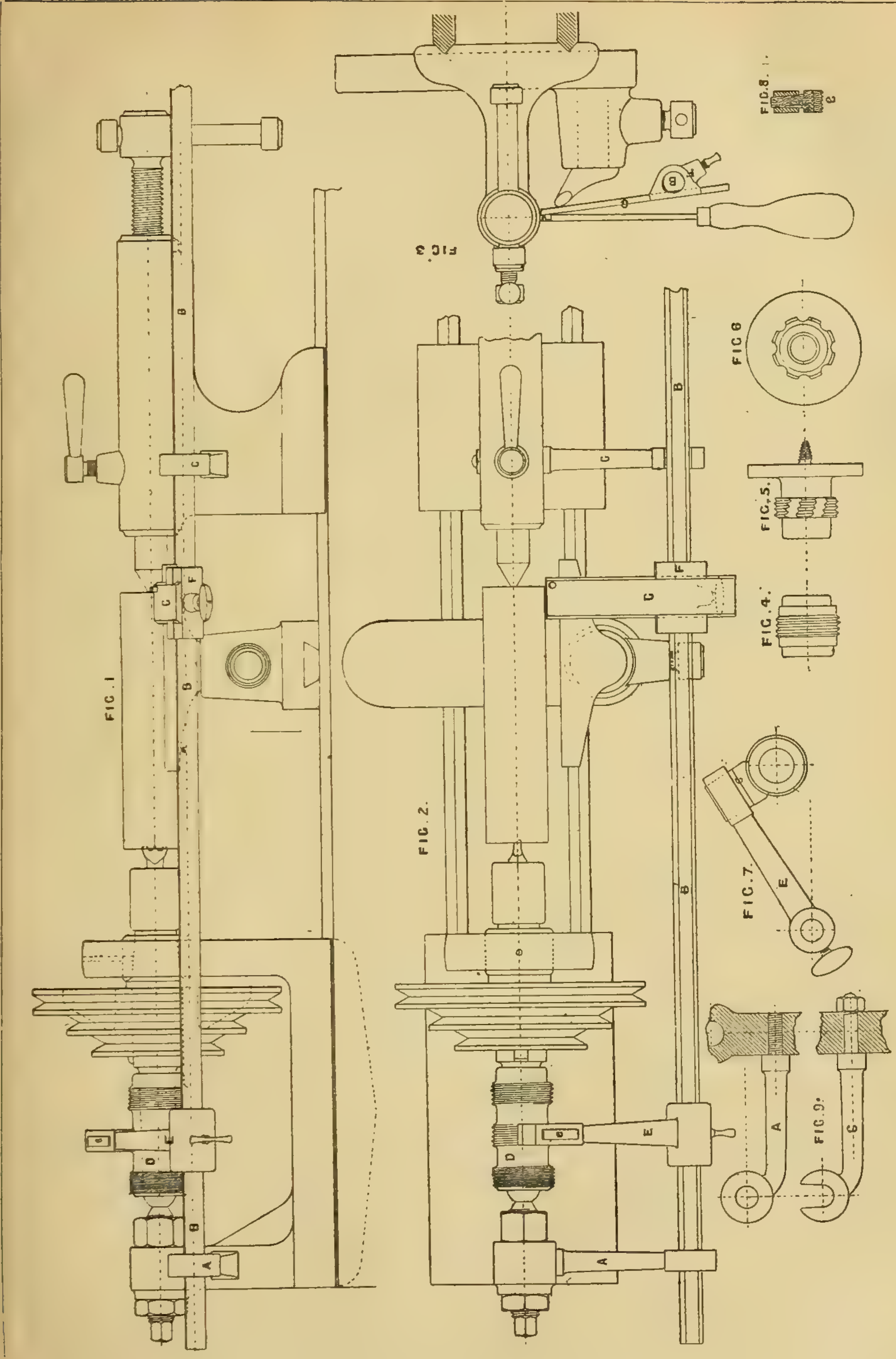


FIG. 1.—ELEVATION OR FRONT VIEW OF THE TRAVERSING BAR. FIG. 2.—PLAN. FIG. 3.—END VIEW. FIGS. 4, 5, 6.—DIFFERENT FORMS OF CHUCKS FOR THE RECEPTION OF THE SCREW FERRULES. FIG. 7.—ARM FOR CONVEYING MOTION FROM GUIDING THREAD TO TRAVERSING BAR. FIG. 8.—WOODEN DIE OR HALF NUT TO RECEIVE MOTION FROM SCREW FERRULE. FIG. 9.—CARRYING BRACKETS FOR TRAVERSING BAR.

it quite touches at the other side. You can deepen the thread so that it becomes loose and closes all round; but now it is only held up at one side, and you can open the crack at the other wide enough, at any rate, to get in a sheet of writing paper. The traversing mandrel and traversing bar will obviate this defect, but only if the screw ferrules which form the guides are themselves true.

NOTES ON NOVELTIES.

By THE EDITOR.

33. Gas Fitting. 34. Barnard's Patent Varnished Magic Lantern Slides. 35. The Artists' Manual of Pigments. 36. Perry and Company, Limited.

33. GAS FITTING.—Messrs. Crosby Lockwood and Co., 7, *Stationers' Hall Court, Ludgate Hill, London, E.C.*, the fortunate possessors of "Weales' Rudimentary Scientific and Educational Series," are indefatigable in adding new and desirable volumes to the series, or in bringing out new editions of the older volumes, with information brought down to date. One of the latest additions, No. 259, sold at 2s. 6d., is "Gas Fitting: a Practical Handbook treating of Every Description of Gas Laying and Fitting," by John Black, with 121 illustrations. Amateurs who are interested in gas fitting, and all who are desirous of gaining information respecting it, cannot fail to derive much benefit from its perusal, and, indeed, careful study. It has been the aim of the author, as he tells us, "in clear and simple language, to go through the practical details of a handicraft on which, we believe, no handbook has yet been published. Fragmentary allusions to various methods, occasional receipts or wrinkles which are useful to a gas fitter, have appeared in trade and general journals from time to time; but there has, no doubt, been felt by many a need of a practical treatise dealing in a consecutive form with the operations of gas fitting." A perusal of the volume will show that Mr. Black has succeeded admirably in giving a lucid exposition of the work which he undertakes to describe in all its branches. In addition to the ordinary operations necessary to gas lighting, he devotes a chapter to the fixing of cooking and warming stoves, and his concluding remarks, entitled "A Word to Consumers," will be read with interest and profit by all who burn gas.

34. *Barnard's Patent Varnished Magic Lantern Slides.*—So many readers of AMATEUR WORK are interested in magic lanterns and painting slides for them, that I am sure they will thank me for calling attention to the fact that I have received from Messrs. J. Barnard and Son, 19, *Berners Street, London, W.*, their latest Catalogue and Revised List for 1886-87 of "Patent Varnished Magic Lantern Slides and Chromo-printed Pictures for Making Slides." These varnished slides, a list of which is too long to give here, but which may be procured on application to Messrs. Barnard and Son, are supplied, mounted on 3¼ inch square glasses, in sets of twelve slides, at 12s. per set; but the chromo-printed pictures, to be transferred to glass for magic lantern slides, each sheet containing twelve pictures 3¼ inches in diameter, are sold at from 4s. to 6s. per sheet. It will be useful to give here a description of the method that must be followed in transferring the designs to glass:—"The coloured designs should be first carefully coated with glucine, applied with a hog-hair brush, and allowed to dry—this will occupy two days. The glass must be well cleaned and the design cut to the same size, after which the picture must be immersed in clean cold water for a few seconds, next place the coloured surface on to the glass and roll well down with the roller to exclude air bubbles; allow it to remain for a few minutes; after which carefully raise the paper at the edge, removing it entirely, leaving only the coloured design on the glass, this should be washed with a camel-hair brush and clean water; the blotting paper must then be placed over the picture, which is again to be rolled down. The picture should then be left for twenty-four hours, when, with a camel-hair brush, it must be carefully varnished over with Chinese varnish, and allowed to remain until perfectly dry and hard. The process is then complete. With regard to mounting the glasses in the frames for the preservation of the picture, it is advisable to place a clear glass, of the same dimensions, against the varnished side of the design, then bind the two together with a strip of thin paper a quarter of an inch wide. This completed, place the two glasses in the frame, and, in the case of the circular ones, fasten it by means of the ring, which is secured with needle points. For square slides needle points are not necessary." Any further information that may be required or desired will be found in a little work by Mr. S. T. Pike, entitled "The Use of Chromo-printed Pictures for the Magic Lantern," supplied by Messrs. Barnard and Son, at 6d., or post free for 7d. All necessary materials for making magic lantern slides are supplied by Messrs. Barnard and Son, and will be found, with prices duly specified, in the price list to which reference has been made above.

35. *The Artists' Manual of Pigments.*—This work, written by Mr. H. C. Standage, author of the series of papers on "Repoussé, or Beaten Metal Work," now appearing in this Magazine, and published by Messrs. Crosby Lockwood and Co., 7, *Stationers' Hall Court, Ludgate Hill, London, E.C.*, has been so recently noticed by me (see Vol. V., page 427, otherwise Part 56, July, 1886), that it is unnecessary to say more than that it has reached a second edition, and this, in the short space of six months. I congratulate Mr. Standage and his publishers. I wish the latter would name the prices of the books they send for notice, as I am still unable to give the price of this work.

36. *Perry and Company, Limited.*—This well-known Company, whose addresses are, 36, *Lancaster Street, Birmingham*, and *Holborn Viaduct, London, E.C.*, steel pen makers of note, and purveyors of many articles and inventions useful to amateurs, still continues to flourish, as is evinced by the fact that a dividend of 10 per cent. is again recommended for the present year, being the same as that which has been declared and paid for the last three years. Moreover £2000 has been placed to Reserve Fund.

The Secretary is Mr. J. W. Milligan, who should be addressed at the Birmingham house of business.

AMATEURS IN COUNCIL.

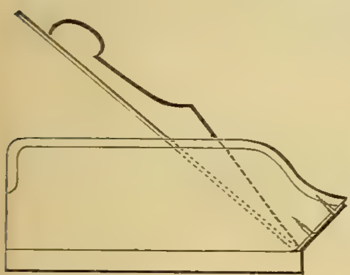
For "Instructions to Contributors and Correspondents," see page 44 of this Volume, or Part 60, page 44.

Zilles' Fretwork Designs.

Mr. HENRY ZILLES (9, *South Street, Finsbury*) writes :—"I have reduced my designs for fretwork, etc., to 2s. per dozen sheets, or 2½d. per sheet, postage extra. I will thank you to mention reduction in prices of my patterns, which are now in the reach of all." [Here we have a notable example of cheapness associated with excellence. In days gone by, cheapness, as a rule, went arm-in-arm with nastiness, but Mr. Zilles, and others, have succeeded in upsetting the application of this saying as a general thing and matter of course.—ED.]

Stop Chamfer Plane.

⁂ The drawing for the modification of the Stop Chamfer Plane, described in page 240 of this Volume by SKIDDAW GREY, was mislaid by the engraver, and the engraving was not received in time to accompany the



STOP CHAMFER PLANE.

description. On the principle "Better late than never," the illustration is inserted here to enable readers to understand fully the nature of SKIDDAW GREY'S modification.

Bookbinding for Amateurs.

H. C.—Papers entitled "Bookbinding for Amateurs" appeared in Parts 6, 8, 10, 12, 16, 18, and 21 of this Magazine, price 6d. each. All back parts are always kept in stock.

Bee-Hives and Bee-Furniture—Errata.

Mr. WALTER J. STANFORD writes :—"In Fig. 6 in Folding Sheet issued with Part 64, the length of the side should be 2′ 1″, not 2′ 7″, as printed. In Fig. 12 the drawing is incorrect, being 5 inches too short in length, to scale."—[The Diagrams were faithful copies of Mr. Stanford's original drawings.—ED.]

Violin Making.

S. M. L. (*Goderich, Canada*) writes :—"I have, during summer and fall months of last year, amused myself making a violin after the directions of Mr. E. H. Allen, though not using his outline. The Swiss pine I procured of Mr. W. E. Hill, *London, England*, through a friend. Mr. Hill's courtesy in supplying this splendid wood was in strong contrast to that of a party mentioned at one time in AMATEUR WORK as a dealer in gums, etc., who gave my friend a *very warm* (I'll call it) reception on his asking for dragon's blood. The violin has only one coat of varnish, owing to its being finished late in the year. I have been playing on it for some time; the tone is particularly free from 'woodiness,' clear and equal on all strings; is much admired by all who have tried it, and is much valued by me."

Applegarth's Corrugated Carbon Cells.

Mr. ALEXANDER WATT writes :—"I observe in your February Notes (page 189, reply to LEX), that reference is made to a 'modificcaion of a Daniell cell, such as that recommended by Prof. Marisseaux in Part 49.' So far as I am aware, the suggestion of the corrugated copper cylinder for batteries was first proposed by myself in the Sixth Edition of my 'Electro-Metallurgy Practically Treated,' Weales' Series, 1877."

Electric Alarum Bell.

J. F. S. (*Edinburgh*).—1. Any ordinary electric bell may be made to do the duty of an electric alarum by connecting it with a going clock of any kind. You have merely to connect the metal framework of the clock with a wire running from the bell; then fasten a quadrant or a circle of brass to the clock around the face, and connect this quadrant or circle with a wire running to the battery, and from thence to the bell. A small bent hand of platinum wire is made to be attached to the brass circle by means of a small set screw, and holes to receive the same are made in the circle opposite each half hour. To fix the alarum, place the platinum hand near the required time, turn it over the face of the clock in a position to bring it in contact with the hour hand of the clock, but so as to allow the minute hand to pass over it freely. When the hour hand of the clock comes in contact with the platinum wire, the bell will ring and continue ringing until switched off. 2. The Editor has a paper in hand on "How to Make a Wire Covering Machine," and this will be published soon. 3. Wires may always be connected to battery elements by soldering; but screw clamps are generally all that is required. Almost any battery may be used to ring the alarum. The battery working an electric clock will do, but more cells should be added to make the bell circuit.—G. E.

Cabinet Carved Work.

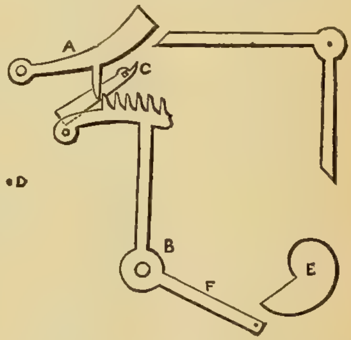
S. M. L. (*Goderich, Canada*).—It is my decided opinion that variety in the use of wood for the above will add greatly to the general effect, in accordance with my recommendation in my concluding paper on this subject. There are at least two courses open to S. M. L., either to make it in some white wood, then stain black and polish (a somewhat laborious process), or, as he suggests, to use, say, *English* walnut for the back and wings, wainscot oak for door-*frames*, and bass wood, or any well-marked grain, for door-*panels*. Light coloured wood will undoubtedly look better than black (stained). I am gratified at finding my designs appreciated so far away as Canada, and I wish S. M. L. every success.—E. A. E.

Curing Rabbit Skins.

C. W. A.—The method of curing skins of all kinds has been described by Mr. George Warden, in his papers, entitled, "How to Stuff and Preserve Birds and other Animals," in AMATEUR WORK, Vol. III., pages 466, 507, otherwise Parts 33 and 34. The following is a recipe for dressing small skins: Mix well one part of alum and two parts of saltpetre, after reducing them to a fine powder. Sprinkle the inner side of the skin freely with the powder, and then fold the skin, bringing the powdered parts in contact and having the fur outside. Roll up the skin as tightly as possible, and tie it round with fine string. Hang it in a dry place for some days, and if the skin be found dry when opened, scrape it clean with a blunt knife, and keep it where it cannot be affected by damp.

Faulty Striking in Eight-Day Clock.

C. H. V. (*Southgate*).—Take off weights, draw head of case off, unhang pendulum, lift movement out on to a table, take off all hands, draw out the pins in the four dial feet, and take it off; now on the left-top corner you will see the part A in enclosed rough sketch, called the rack-hook; B, the rack; C, the gathering pallet squared on the end of an arbor coming through the plate; E, the snail, fixed on the wheel that



STRIKING APPARATUS, EIGHT-DAY CLOCK.

carries hour hand; F, rack-arm. Now there are two very general causes that make the clock strike for ever, one is that the rack-arm (F) is bent up a little too far, and the pin, instead of resting on the snail (E) slips over it, and let the rack teeth fall out of reach of the gathering pallet (C); slightly bend the arm down so that it shall safely catch against the snail, but there ought to be at D a pin in the plate so that it shall stop the rack from falling too far for the gathering pallet to reach the last tooth in the rack. Probably this has been broken off during cleaning, and not replaced, if so, put in any piece of wire of a suitable size and length to reach high enough to catch rack when fallen at twelve. Sometimes the rack-hook is pinned down too tight to work properly, and is lifted up by the lifting arm and sticks there. If not able to cure, write again giving particulars.—A. B. C.

Repousse or Raised Metal Work.

FAT.—In the paragraph headed "Ornamental Ironwork," page 164 of this Volume, you, and readers generally, are requested to substitute the word "brass" for "iron," wherever the latter occurs in this paragraph.—H. C. STANDAGE.

Amateur Darlings.

NIL DESPERANDUM writes:—I have read your suggestions on "writing to the point." AMATEUR WORK is for the million poor and not for the few rich. I think this should be borne fully in mind when such a nicety of skilfulness as "A Reflecting Telescope" is treated on in its pages. "Smithing and Forging" is not interesting enough, and much too coarse, for ninety-nine amateurs out of a hundred, besides the £ s. d. question. If artistic articles and pretty objects were more often the theme, and if there were more amateur darlings such as OLLA PODRIDA, AMATEUR WORK would be more extensively circulated. [I trust OLLA PODRIDA's face will be suffused with a proper and becoming blush of pleasure when he finds that he is actually and positively "Somebody's Darling." Unfortunately there are many readers of AMATEUR WORK who like "coarse" and uninteresting subjects, to judge from the number of requests I had for papers on "Smithing and Forging." Let me, however, say that there are plenty of "artistic articles and pretty objects" on the eve of publication, and ask you to be on the look out for "Hanging Bookshelves" in Carved Work, by Mr. G. A. Rogers; a 'Table Whatnot," by Mr. J. Gleeson-White; "Elizabethan Furniture," by the Rev. Algernon Thorold; and many other things beautiful and useful, with which I am sure you will be greatly pleased.—ED.]

Cutting Letters in Stone.

H. M. proposes to write a few chapters on "Stone Engraving," as applied to tombstones, etc., to include leaded letters and suitable designs. I am obliged to H. M. for his offer, but I think that the subject is unsuited for AMATEUR WORK, and that but very few, if any, readers would care to see it treated. But H. M. may as well send name and address.—ED.

Staining and Polishing Oak.

ACORN.—You do not say the colour of the oak articles you refer to, but I presume you mean the rich brown so often seen in conjunction with silver mountings. If so, stain the wood with a solution of bichromate of potash, or if this alone causes a yellower hue than you wish, as it probably will, add a little of some brown stain such as Stephens' Walnut, or what will do quite as well, a little vandyke brown dissolved in water with a small quantity of ammonia. The strength of the solutions and quantity of each ingredient will depend on the colour and tone desired. To ascertain this try on waste wood till you get what you want. Bear in mind that the wood dries much lighter than it will do when it is finished, as it should be in the ordinary manner with French polish. ACORN will find much valuable information on this subject in the articles, "French Polishing in all its Branches," in Vol. III. of this Magazine.

Development of Negatives.

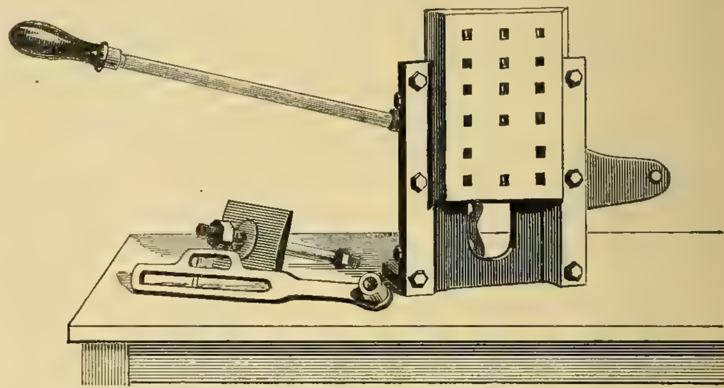
S. T. P.—The instructions for development refer only to collodion negatives. For the Woodbury tissue or for gelatine plates it is advisable to use the developer to which the operator is most accustomed. The formula given by "Edwards" for XL. plates is one of the very best, and failure cannot ensue from its use. The glycerine in this formula can be omitted to advantage. The negatives to be cleared from any yellow tinge, if it exist, should be placed in the solution of alum and citric acid.

Lukin's Vertical Lathe Planer.

MR. ORLANDO JAMES PATRICK, General Engineer, Machinist, etc., *Angel Yard, Tindal Street, Chelmsford*, writes:—"Having accidentally seen a description of the Vertical Lathe Planer as made by me to a design of the Rev. James Lukin, and also favourably noticed by E. G. F. (*Westbury-on-Trym*), I take the liberty of sending you a photo of the attachment as made by me. The height of the planer is 9 inches, and width 7 inches, exclusive of lever, etc., and the stroke is 5 inches vertical. It can be operated either by hand lever or slotted lever to work of pin in face-plate at an extra charge of 6s. Prices are: castings, 10s.; planed, 22s.; finished, 50s. It suits from 3 to 6 inch lathes. The weight in the rough is about 35 lbs. The photo. is from a machine supplied to Major Armstrong, *Gilwockir, Westcombe Park, London*, who expressed himself in the highest terms as to its working, etc. I think this little machine would interest and please a good many of your readers, who, from what I have said, will see that I supply the castings, etc., at a very low price."

Scene-Painting.

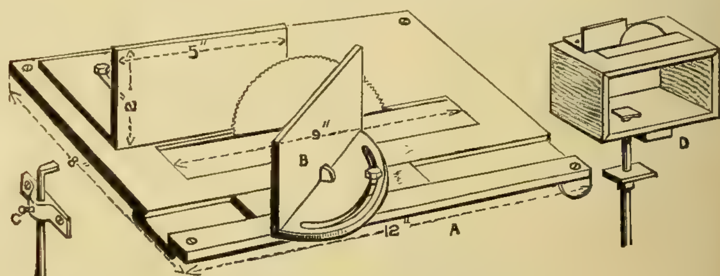
THAUMA.—Your queries relate to conjuring entirely, and are out of place in connection with Scene-Painting or Scenery. The less of this you have on your stage the better, and the modern wizard wears nothing but an evening dress suit. Being a relative of Professor Pepper's, however, and knowing all about what you enquire after, if you will send me your address I will give you some sound wholesome advice by post.—H. L. B.



LUKIN'S VERTICAL LATHE PLANER.

Saw Bench for Use on Lathe.

MR. O. J. PATRICK further writes:—"I also send you a lithograph of Saw Bench for Lathe use, which I think would prove interesting and useful to readers of AMATEUR WORK. The sketch explains itself. In the sketch is shown the angular attachment which I have added at the request of several customers since the saw bench was introduced. To make everything perfectly clear let me add that A shows the saw bench, and gives its dimensions; B is the angular attachment; C, an adjustable rest for supporting the table when tilted; and D, the mode of fixing for lathes. The prices are:—Castings only, plain, 3s. 6d.; angular cutting arrangement, 5s. 6d.; tilting table, 7s. 6d; planed and fences fitted, plain, 8s.; angular cutting arrangement, 15s.; tilting table, extra, 3s. Sixteen inch turned bright spindle, complete, with collar and lock nut, 8s."



SAW BENCH FOR USE ON LATHE.

Messrs. Tangye and Co.

FARIDA.—I am unacquainted with any such firm as Messrs. Tangykes and Co. Perhaps you mean Messrs. Tangye & Co., and whose address is simply *Birmingham*. At all events, a letter so addressed will reach them.

Modification of Slide-Rest for Shaping.

STADT DRESDEN writes:—"I enclose for your inspection some sketches I have made from the arrangements given by A. F. C. (*Bombay*). GOLDSMITH writes rather disparagingly on the matter, as if it were im-

possible. Permit me to state that the arrangement is perfectly feasible, if properly set about. My full-size sketch is partly taken from the head of the No. 1 'Excelsior' hand-shaping machine, of Selig and Sonnenthal, tool agents, and is partly my own idea. The maximum stroke would

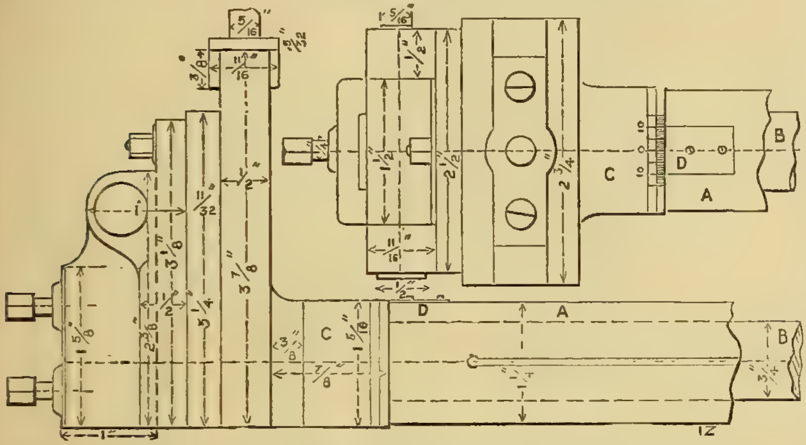


FIG. 1.—STADT DRESDEN'S MODIFICATION OF LATHE PLANER.
Drawn half size for 4½ inch lathe. Will admit from 2 inches to 2¼ inches between Tool and Sliding Table. Z, End of Slide.

be 6 inches. The method of fixing is better than A. F. C.'s. A is a piece of 1¼ inch square planed steel 7 inches long, and slit to within 1 inch of the left-hand end. The steel is also bored through from end to end ¾ inch diameter to take the spindle or shank B, which is screwed firmly into C.

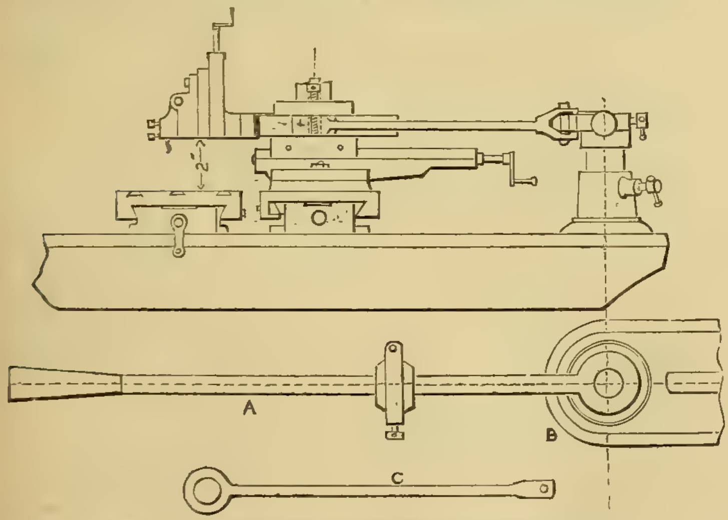


FIG. 2.—COMPLETE VIEW OF SLIDE FOR LATHE PLANER.
A, Hand Lever; B, T Rest Socket; C, Connecting Rod.

On the upper side of A is the pointer, D, for dividing the degrees on C. Merely clamping A down fast on the slide-rest firmly fixes the head in any position. For driving the arrangement I prefer the plan given in my smaller sketch. The largest end of connecting rod fits on the tool post of slide-rest, while the forked end is secured by a pin to the tail of the clamp which slides on hand lever. The clamp being movable, the length of the stroke and the leverage can be easily adjusted. The hand lever works on a stud fitting the T rest socket. If the table is made with dovetailed grooves it need not be more than 2 inches high, so that with a 2 inch packing block under slide-rest a height of 4 inches can be planed on a 4½ inch lathe. With regard to the depth of the cut, it should not exceed 3½ inches. Cast iron will be cut best, judging from the 'Excelsior' shapers. The slotted lever arrangement of GOLDSMITH would require more time in shipping and unshipping, and has also more friction. I don't know if it is the custom among lathe makers in England to supply packing blocks; it is in Germany. I forgot to say that I only remove the screws which fasten the slide-rest saddle to the nut, and not the main screw."

F. A. M. in comment on the above, writes:—"I was surprised a first to see how widely GOLDSMITH and E. J. S. had differed from my own estimate of A. F. C.'s contrivance; but I hope he and others will have noticed that this difference of opinion arises from our having understood the scheme in two different ways. I understood that the cut would be given by racking (not 'rock' as printed) the saddle to and fro on the bed, the feed being by the traverse screw. The other two writers appear to have understood that the cut would be given by turning the handle of the upper slide of the rest; and it was, therefore, no wonder they condemned the scheme. It did not occur to me to suppose that anyone would propose a thing so unsuitable as using the top slide of a rest in that way; but I think GOLDSMITH and E. J. S. were justified to some extent in so understanding it, since in the sketch (page 558, Vol. V.) no rack is shown, whilst the handle of the upper slide shows large. We have now some drawings by STADT DRESDEN showing how he would arrange matters. He, however, still intends using the top slide of the rest, instead of moving the whole saddle on the bed, and therefore I can only say he makes the best of a bad job. STADT DRESDEN'S proportions and details appear to me about right, except that I should prefer to have a large flange on the end of the 1¼ inch square bar, with two circular slots and divisions on the flange. The tool-holder, too, would have to be unusally strong. It is strange that none of us have noticed that the slide under A. F. C.'s planing table is of no use at all, since the side feed could be given just as well by the cross slide of the rest. This greatly simplifies matters and gains us an inch in height. Let A. F. C. have a simply planing bed made to screw down on the bed of the lathe, having T slots running lengthways of the lathe-bed and planer-bed, which latter might be about 9 inches long and 6 inches wide, and, say, 1¼ inches thick; then have the planer arm made to STADT DRESDEN'S plan. Now, if he does not mind using the rack, he will have all he requires. If he wishes for the smooth and pleasant action of the horizontal handle, that is not a great matter to add. The top slide of the rest should by no means be used, but it should be *pinched tight* by the gib screws so as to become as one piece with the rest, when planing is to be done. The automatic feed is very easy to arrange by means of a small change wheel fitted on to the front end of the traversing screw of the saddle. I still think this arrangement to be as good as any lathe-planer I know of, and simpler than any. Amateurs often do not realize how much planing they can do on the face-plate by turning in the usual way. Very probably A. F. C. could face up a larger surface on his face-plate than on his planer, even if he had it fitted as I have advised. A lathe-planer is of little use after all, except for V edges and such-like work."

OLLA PODRIDA writes:—"Who said that it was not possible to carry out such an arrangement? No one. Who discovered (?) that it was 'perfectly feasible'? STADT

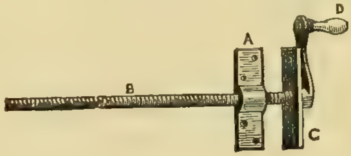
DRESDEN. And what a boiling time he must have had over the hatching of new ideas (?). As to the latter, I fail to discern them in the arrangement sketched, and where Selig and Sonnenthal end and are exhausted, and STADT DRESDEN begins! Probably amongst the minute fractional dimensions added to his sketch, which, by the way, must be marvellously exact, and a fair specimen, I might presume, of German copyism. He really ought to have been more explicit, and clearly pointed out the favoured ideal portions of the arrangement. Credit could then have been rendered where credit is due, or rather claimed. With respect to packing blocks, we do not supply them unless specified. Their use is quite familiar even in England, but where a 10-inch lathe is required we are not in the habit of supplying or applying a 5-inch lathe. I agree with F. A. M. and GOLDSMITH in that the lever is far preferable to the screw. If the lathe is fitted with rack hand traverse then that could be used. I have cut hundreds of toothed wheels in that fashion, and also key-ways of large size. The lever and connecting-rod is better than the slotted lever and pin, in that it is cheaper to make."

Working Model Locomotive.

S. M. L. (*Goderich, Canada*) writes:—"I have much pleasure in sending you herewith a stereoscopic card of the small locomotive made in the United States, about which I wrote to you some time ago. If any of 'ours' in the model line cast any doubts on the working of this locomotive, you can tell them they are mistaken." [The stereoscopic card shows a very elaborate and beautifully finished engine and tender. The following is printed on the back of the card: "Smallest Complete Working Locomotive in the United States. Built by F. Van Fleet, *Williamsport, Pennsylvania.* Equipped with all modern improvements. Complete system of air brakes, both automatic and straight, on drivers and tank. Built of gold, silver, German silver, brass, steel, copper, iron, and nickel. Built to scale; $\frac{3}{8}$ in. equals 1 foot, or $\frac{1}{32}$ full size. *Dimensions.*—Length, engine and tender, 19 in.; height, $5\frac{1}{2}$ in.; width, $3\frac{1}{2}$ in. Length, engine, 12 in.; tender, 7 in. Diameter: cylinders, $\frac{9}{16}$ in.; stroke, $\frac{7}{8}$ in. Air pump, $1\frac{3}{8}$ in. long, $\frac{1}{2}$ in. diameter. Injector, $1\frac{1}{4}$ in. long, $\frac{1}{8}$ in. diameter. Steam gauge, $\frac{1}{4}$ in. diameter. Driver brake cylinders, $\frac{3}{8}$ in. long, $\frac{1}{4}$ in. diameter. Head light, $\frac{5}{8}$ in. diameter, burns oil one hour. Signal lamps, $\frac{1}{2}$ in. long, burn oil twenty minutes. Driving-wheels, $2\frac{1}{4}$ in. diameter. Truck wheels, $\frac{3}{4}$ in. diameter. Tank wheels, $\frac{13}{16}$ in. diameter. Blowback safety valve, $\frac{1}{8}$ in. diameter. Main rods, $2\frac{3}{4}$ in. long. Side rods, $2\frac{7}{8}$ in. long; width, $\frac{1}{8}$ in. Links, steel, $\frac{11}{16}$ in. long; width of slot, $\frac{3}{32}$ in. Link block, $\frac{1}{8}$ in. by $\frac{3}{16}$ in. Hexagonal nuts, bolts, 120 threads per inch. Diameter stock, $\frac{1}{4}$ in.; height, 2 in. Steam dome, 1 in. diameter; height, $1\frac{1}{2}$ in. Oil cups, $\frac{1}{32}$ in. bore. Boiler, diameter, $1\frac{1}{2}$ in.; length, 10 in., including extended smoke-box; fire-box, $2\frac{1}{4}$ in. long, $1\frac{1}{4}$ in. wide. Steam pressure that can be carried, 125 lbs. Slide valves, $\frac{1}{4}$ in. wide, $\frac{3}{8}$ in. long. Steam ports, $\frac{1}{16}$ in. by $\frac{3}{8}$ in. Exhaust ports, $\frac{3}{32}$ in. by $\frac{3}{8}$ in. Can be fixed and run in the same way as an ordinary locomotive. Fitted to burn either oil, coal, or coke. Weight about 15 lbs." I quote the above dimensions as they may be both useful and interesting to those who take pleasure in model engine-making. At the same time, I may add that I can furnish no more information respecting this model locomotive than what is given above. Letters of inquiry should be addressed to the builder of the engine, Mr. F. Van Fleet, *Williamsport, Pennsylvania.* If any readers, however, have any questions to ask of S. M. L. (*Goderich, Canada*), I will insert them as "Information Sought." If any letter is sent to be addressed and forwarded to S. M. L., it must bear stamps to the value of 2½d. No notice whatever will be taken of any letter sent to be forwarded if not stamped to this amount.—ED.]

Attachment of Focussing Movement to Camera.

CLYDE. — I do not know much about Marion's Oxford Camera, but, if I remember right, it has folding baseboard and vertical swing. If this is so I fear you will have some difficulty in attaching a rack and pinion movement for focussing. A winch-screw will be more easily attached, and, I should think, will answer your requirements equally well. However, should you prefer the rack and pinion, you will find diagrams and instructions for fixing to



ATTACHMENT OF FOCUSSING MOVEMENT TO CAMERA.

camera in Mr. Parkinson's papers in Vol. II., page 63. The annexed cut illustrates the screw movement; you will readily see how it should be attached. The nut, A, which runs on the screw, B, is screwed to the bottom of the camera back, the plate, C, to the end of the baseboard. On the handle, D, being turned, the nut moves on the screw, thus adjusting the camera back as required. I shall be glad to procure CLYDE the necessary fittings, or he may get them from Lancaster, *Birmingham*; Mr. Hy. Park, 1, *Orchard Buildings, Kingsland Road, E.*; and, I believe, Mr. A. A. Pearson, *Leeds*. The cost for half-plate camera will be about 3s. 6d. or 4s.—C. C. V.

Photographic Enlarging Camera.

ANXIOUS.—A Pamphengos lantern will be found to answer very well if arranged in such a manner that it may take the place of the lantern body shown in my Folding Supplement. You must first remove the front staging and the condensers, and then attach the small end of the Kinnear bellows to the lantern front by means of four hooks, such as Fig. 10; these must be screwed on to the frame that carries the bellows, and when in use should slip over small brass screws, placed at the required height in the side of the lantern body. It, therefore, becomes apparent that the lantern may be used without disfigurement, and that no alteration in the arrangement of the apparatus is necessary beyond the substitution of one lantern body for the other. It will not matter if the opening in the front of the lantern body is a little less than 6 inches, provided the lamp can be kept as near to it as possible. I may here state that the lamp I use is precisely similar to the one figured in page 125 of the present volume. (It may be bought from Messrs. Newton and Co., 3, *Fleet Street, London*, for 16s. 6d.) With regard to the condenser, Messrs. J. Lancaster and Son, *Colmore Row, Birmingham*, will supply 6 inch, 40s., 7 inch, 60s., 8 inch, 75s.; these are a thoroughly good article, well mounted in brass. They may with advantage be purchased second-hand, *provided there are no scratches on them.* Apply to Messrs. Sands and Hunter, 20, *Cranbourne Street, London, W.C.* I have frequently obtained from them splendid lenses and apparatus at very low prices; or try Prof. Caplatzi, 1a, *Chenies Street, Tottenham Court Road, London, W.C.* Another good plan would be to advertise your wants in the "Bazaar," and obtain the condenser *on approval*, depositing the cash with the Manager, which will be returned if the article prove unsatisfactory, each paying the carriage one way. I may add that I employ 6-inch condensers for my own use, and find them all I require; the small portion of the half plates that is cut off does not matter, as I mostly vignette the enlargement; in fact, I always do so with opal. If larger condensers than 6 inch are used, the only alteration in the camera will be to make the circle in the frame, Fig. 9, of the required size. Some idea of the requisite time for exposing the bromide paper may be gathered from the following example: Supposing, for instance, that five seconds would be the correct exposure at the distance of one foot from the source of light, the same paper would require an exposure of twenty seconds at a distance of two feet, and forty at three feet, or eighty at four feet.—C. A. P.

Wood Engraving.

R. J. F. (*Halifax, N.S.*)—There are books on wood engraving—I noticed one of them not long ago in "Notes on Novelties"—but as far as I can judge they are not precisely what a novice and beginner requires. I have asked a wood engraver, who has a complete and practical knowledge of the work, to prepare a series of papers on the subject for AMATEUR WORK, and I hope he will soon put pen and pencil to paper and wood, and enable me to begin their publication without long delay. I am sure that his instructions will be practical and serviceable to amateurs.

Bagatelle Table.

P. H. S. (*Brixton*).—An article on this subject is being prepared by A. SINUS.

Utility of "Amateur Work."

ONLY AN AMATEUR writes:—"I have learned much from Mr. Vevers' papers on Photography in AMATEUR WORK, and heartily thank him and yourself for that and other things I have learned from the pages of our Magazine. I have been a subscriber since the issue of the eighth Part, and am now making my living almost entirely from what I have learned from

AMATEUR WORK." [I am glad to find that the Magazine has proved so helpful to you. It is a satisfaction to me to find that the thanks I and the contributors to its pages receive from readers greatly outnumber and outweigh the objections to certain subjects which have been treated in its pages, and in this we are far more fortunate than the traditional monkey, who got more kicks than halfpence.—ED.]

Interchangeable Billiard and Dining Table.

H. B. J. (*Worcester*).—I have an article on this subject in hand, and I hope that in due course it may be of use to you. You are in error in stating that I think a bagatelle table would be more suited to your tastes. My objection to a combination table is merely that owing to its small size and the difficulty of obtaining the perfectly accurate level necessary for billiards, I feared that you might be disappointed with the result. I therefore suggested a bagatelle table, but if you do not expect a "Burroughs and Watts'," you may derive much enjoyment from the home-made article.—A. SINTS.

Russian Iron.

The AUTHOR of "THE MAGIC LANTERN: HOW TO MAKE IT AND USE IT," writes:—"In answer to your inquiry respecting 'Russian iron,' which some of the readers of AMATEUR WORK have asked for without success, let me say that by this term the best sheet iron is meant. The magic lantern makers generally call their lanterns 'Russian iron' lanterns, and understand what is meant by the term, and would supply sheet iron of the proper thickness if applied to." [Why magic-lantern makers should call the best sheet iron "Russian iron" is difficult to understand. Perhaps some maker will kindly explain. By giving names to materials which are not generally known in and accepted by the trade at large, much difficulty is occasioned, and most unnecessarily, to persons who are led to seek for material masquerading under a name to which it has no fair title.—ED.]

Magic Lantern Slides.

H. S.—In answer to your inquiry I would say there is no need to protect painted slides for the magic lantern, when finished, by varnish.—O. B.

Amateur Mechanics' Associations.

MR. THOS. J. SYER, Principal, Finsbury School of Amateur Mechanics, 2, *Chiswell Street, London, E.C.*, writes in comment on the suggestion made by A. F. C. (*Bombay*), page 240:—"The matter of an Amateurs' Association or Club is a very good idea, if worked out under good management, but before anything of the kind could be established it would be necessary for a number of gentlemen to come forward as guarantors. I shall be pleased to take up the matter, to receive names of any persons willing to become subscribers, etc., and make the necessary arrangements."

Stage Carpentry.

STAGE MANAGER.—1. It rests with the Editor as to articles on "Stage Carpentry" appearing. At present I have not commenced to collect new materials for such a series. If they should appear they would give full instructions and working drawings of the framework used in "Fit-ups." 2 As to "Stage-cloths"; read my remarks again carefully, my fault usually lies in explaining things with too much detail and repetition, and even then it seems I am not always clearly understood. You cannot paint glass, it is merely a green wash. Built flower beds are connected with carpentry. If you want to know how to make them, write again when you do.—H. L. B.

Lens, Etc., for Magic Lantern.

FARIDA.—Tin sheet is merely iron dipped in tin. You can easily judge of the substance of the sheeting you will require for making a magic lantern by handling it, and any dealer to whom you may apply will tell you what is best fitted for your purpose, if you tell for what the material is required. The lenses are 4 inch lenses, as mentioned in commencement of Chapter II., page 123 of this Volume.

Electric Bells.

FARIDA.—A paper by Mr. G. Edwinson on "Electric Bell Indicators" appears in Vol. IV., page 263, otherwise Part 41.

Half-Plate Camera.

C. B. T. W.—The dimensions of the different parts of the Camera depend upon the make of dark slide to be used with camera. I should advise you to purchase your first slide, and this will give you the inside dimensions of camera. Even if you make your own slides it is best to make one first, and to build the camera afterwards. The holes in sliding fronts must be made to suit the lens to be used with the camera. They would require to be about three times the size for French portrait lenses that they would be for landscape lenses by the best English makers.—J. P.

Boots and Shoes.

A. B. C.—For machine-sewn boots and shoes, the whole of the bottom, inner and outer soles are sewn in one operation, as a rule; but there are some which are sewn through, and then the outer sole is stitched on as though by hand. You can soon tell if they are done in this way, as when the outer sole is cut off the other stitches are laying on the under. Boots done this way can be sewn again just like hand-sewn. In any case, if the outer sole is ripped off carefully, the rest will not move. Riveted boots are very often done in one nailing, besides the lasting; but in a stout-edged boot the middle soles are generally nailed and then the sole afterwards. In either case it is only a little care wanted in pulling off the sole and all will be right. In machine-sewn be careful to nail further than you rip, for when the stitches are once cut they go all round unless held.—A. W.

Another Lathe Planer.

G. M. B. writes in comment on H. H. D. B.'s Lathe Planer, page 190:—"I think you ought to get a cast-iron sole-plate for your planer, as I doubt if a wood frame would be stiff enough, rigidness being of the greatest importance in a planer. An iron sole-plate similar to a horizontal engine one would answer, with two castings of L section, cast with, or bolted to, the top of it at each end; these would carry the bars, which, I think, would do at 1½ inches diameter. I also notice the T slots show from end to end of the table, and they would serve their purpose better across it. I would make the bars of the best round iron, and the upper half of the bearing J of gunmetal.

MR. W. BALCK, commenting on H.H.D.B.'s Lathe Planer, writes:—"This design would most likely answer its purpose, but it would be as costly and very much more cumbersome than a separate ordinary planer; and I am very much afraid that rigidity could not be obtained if round turned slide bars are introduced. Briefly speaking, the novelty of design is, in my opinion, a positive disadvantage.

Tripod Stand for Camera.

PATTERN MAKER.—You will find sketch and description of a folding tripod stand for camera in AMATEUR WORK, Vol. IV., page 267 (otherwise Part 41), in Mr. John Pocock's papers, entitled, "Photographic Apparatus: its Preparation and Construction."

The Four Dollar Chuck.

MR. C. A. PARKER writes:—"Thinking that perhaps some of your readers might be glad to know where the 'Four Dollar Drill Chuck,' figured in page 143, Part 62, could be obtained, I beg to say that Mr. A. S. Lunt, 297, *Hackney Road, London, E.*, can supply them for 20s., being known under the name of 'the 1876 Drill Chuck.' Amateurs would do well to send four stamps for his list, as the tools sold by him are both cheap and reliable."

Fret Cutting—Wood Carving, Etc.

F. R. GRASSBY, 26, *Salthouse Lane, Hull*, writes:—"For the information of ESOR and others who may be seeking assistance in Fret Cutting, Wood Carving, etc., I beg to say that I am willing to undertake all kinds of wood carving and model casting, and fretwork to order; small figures and any kind of wood carving, closely roughed in for amateurs to finish, or finished, as required."

SIDNEY A. HOLLAND, 5, *St. Mary's Road, Southampton*, writes:—"Seeing in 'Amateurs in Council' that the names of persons willing to cut fretwork are wanted, I should be pleased to cut any patterns or designs sent me."

INFORMATION SUPPLIED.

Recipe for Glaze.

POLISHER writes in answer to W. G. G.:—"A good glaze may be made by dissolving 3 oz. benzoin in half pint methylated spirits. A smaller proportion of benzoin may be used, but the result will not be so good. Dissolve cold, owing to danger if the spirit be heated."

Lessons in French Polishing.

A. T. (*London, S.W.*), writes in reply to W. G. G. (page 192):—"I can strongly recommend Mr. T. Syers' class for lessons in French Polishing, held at *Finsbury Chambers, No. 1, Chiswell Street, E.C.*, every Monday evening at from 8 to 9 o'clock. I am attending this class, and am well pleased with the practical lessons which I am receiving." [This is an excellent op-

portunity for W. G. G. Mr. Syers did not let me know that he was giving special lessons in this art. Had he done so, I should have mentioned it.—ED.]

Automatic Fire Extinguisher.

AJAX writes in reply to F. S. (*Folkestone*) —"That the system referred to is probably the 'Grinnell,' in which the valve immediately over, or nearest to, the outbreak is opened by rise of temperature, and discharges a stream of water on the flames. The agents for this patent are the Harden Star and Sinclair Company, 114, *Cannon Street, E.C.*, who, however, intimate that they are just bringing out another system, which they consider an improvement on the above-named."

J. A. (*Whitby*) writes in reply to F. S. (*Folkestone*), page 192:—"If you will get 'The Miller' for January, 1887, published by Wm. Dunham, 24, *Mark Lane, London, E.C.*, price 5d, you will get the information you require, with other particulars which may be of great value to you."

Recipe for Glaze.

W. J. M. (*Birmingham*) sends the following Recipe for Glaze for W. G. G.:—Take 3 ozs. gum benzoin, 1 oz. gum sandarac, crush up finely, put into an empty wine bottle, add 1 pint of methylated spirit, set by in a warm place, well shaking occasionally, after standing twenty-four hours strain into a clean bottle. This improves by keeping.

Lessons in French Polishing.

OLD CRANLEIGHAN writes in reply to W. G. G.:—"Mr. Thos. J. Syer has classes for French Polishing among other subjects at 'The Finsbury School of Amateur Mechanics,' *Finsbury Square Buildings, Chiswell Street, E.C.*, and by joining these he would learn all he wishes to know."

YORKSHIRE sends the following practical answer to W. G. G. (page 192):—"First see that your work is smooth and free from dust, then oil the parts to be polished with raw linseed oil, then prepare your filling in. This is done with a mixture of whiting and turpentine, made into a paste and rubbed well into the grain of the wood with a piece of rag: then wipe clean off. Make the filling as near colour of wood as possible. For filling in oak, ash, or satinwood, take ½ lb. mutton suet or tallow, with 1 lb. plaster of Paris, melt it together, rub well into grain of wood, and wipe clean off before you commence to polish. To use the polish, prepare a rubber of cotton wadding according in size to the job, wet it with polish, then cover the rubber with a piece of old cotton rag, twist the rag and keep it tight over the rubber, put just a drop of raw linseed oil on it, then proceed to rub your job in a circular direction, keeping your rubber in constant motion; work the rubber dry before wetting again with polish and change to fresh place on rag. Get a good body of polish on the work, and then set it on one side for about twelve hours to sink. Then polish it up again, let it harden, and go lightly over it with a clean rubber with clean spirit and the least drop of oil on rubber; just go straight over it once, to prevent tearing polish up. Some polishers use glaze to finish off with instead of spirit; it is easier, but not as good as the spirit. Use as little oil as possible, just to prevent rubber sticking, as it comes up and makes the work sticky and dull. By all means work in a warm place, and with a little practice you should succeed."

H. W. (*Bermondsey*) writes in reply to W. G. G.:—"Mr S. Smith, *The Studio*, 11, *Malvern Road, Dalston, London, N.*, teaches French Polishing and all its kindred branches in a few lessons. W. G. G. could not do better than write for prospectus, the cost of which is 2d."

[To this H. W. adds:—"Cutting herewith from 'Carpenter and Builder.'" No cutting reached me. When correspondents send small cuttings it is better to attach them to their letters by paste or pin.—ED.]

Glaze, Polish, etc., Where to Buy Them.

YORKSHIRE writes in reply to W. G. G. (page 192):—"I cannot tell you where to buy polishes, etc., but what will perhaps be better, I can tell you how to make them, and you will then be able to make any quantity. Materials can be obtained at any chemists'. (1.) Brown Polish.—4 ozs. orange shellac, 1 pint methylated spirit. (2.) Red Polish.—4 ozs. orange shellac, 1 pint methylated spirit, 1 oz. dragon's blood. (3.) White Polish.—4 ozs. white shellac, 1 pint spirit. (4.) Black Polish.—4 ozs. white shellac, 1 pint spirit, 1 oz. vegetable or gas black. To these I append a recipe for Glaze.—1 oz. gum bezoin, ½ gill methylated spirit."

INFORMATION SOUGHT.

Amateur Workshop.

J. A. (*Whitby*) asks:—Will some of our amateur friends give us another design for an amateur workshop, fittings, etc.? We have only had one since the commencement. [Our correspondent should give particulars as to site, position, and the size of the workshop he wishes to put up, and then there would be a better chance of offering suggestions that would meet his views.—ED.]

Bird Cages.

E. D. (*Manchester*) asks:—Can any of my fellow-readers tell me how to make a bird-cage—a large one—say, 2 yards long by 2 yards wide by 2 yards high, or thereabout; stylish, partly wood and partly glass, or wire and glass?

Pair of Scales.

E. D. (*Manchester*) wishes to know how he may make a pair of scales for the household, for weighing bread, meat, etc.

Cement for Paper and Iron.

PATTERN MAKER writes:—"I want a receipt for a waterproof adhesive solution for attaching brown paper to iron patterns. Glue or paste will not answer, as the damp moulding sand causes it (the paper) to peel off." [Have you tried Le Page's Carriage Glue. If not, you might do so. It will cause wood and iron to adhere.—ED.]

Gilding Silk Banners.

N. P. A. asks:—Can any reader inform me what description of gold is used, and how the same is applied to Silk Banners? [Gold leaf is used, and this you may obtain cheap and of excellent quality from Mr. Walter T. Craig, *Miller Street, Wick, N.B.* The ordinary way of gilding would be to size the parts to be gilded, and when the size is nearly dry to apply the gold leaf. Perhaps someone who is accustomed to this kind of work will give more detailed instructions.—ED.]

Albert Memorial.

W. E. M. asks:—Can any reader of AMATEUR WORK inform me where I can obtain a fretwork pattern of the Albert Memorial in a reduced scale, and also the price of same.

Automatic Cinder Sifter.

E. C. B. (*Tunbridge Wells*) asks:—Will anyone give a description of the inside construction of an upright Cinder Sifter which I have seen advertised at about 30s.; and which, I think, is described as follows:—Cinders put in at the top, shut the lid down, and then pull out a drawer at the bottom, where the cinders are found ready sifted. [It is the "Loughborough" Cinder Sifter, manufactured and sold by Messrs. Messenger and Co., *Loughborough*.—ED.]

Magic Lantern Effects.

GIBRALTARIAN writes:—"Will LINDUM (Vol. V., page 331) kindly tell me how I can make a diaphragm to produce the rolling curtain effect on the Magic Lantern; also where I could get Pumphrey's Vapourizer." [The various effects produced in the Magic Lantern will be described in the papers now appearing on the subject. Mr. A. Caplatzi, 3, *Chenies St., Tottenham Court Rd., W.C.*, keeps scientific apparatus of every kind on sale, and it may be possible to obtain Pumphrey's Vapourizer of him.—ED.]

Small Gas Engine.

FRIEND-IN-NEED writes:—"I should be much obliged for some information as to the making of a small-power gas engine suitable for driving a 5 inch lathe. I am sure it would be a great addition to the amateur workshop."

Light French Polish.

W. G. G. asks for a recipe for light French polish for light-coloured woods.

The Four Dollar Drill Chuck.

S. M. L. (*Goderich, Canada*) writes:—"In the 'Four Dollar Drill Chuck,' illustrated in page 143, AMATEUR WORK, Jany., 1887, there are two small screws in the sides: are these intended to be screwed home after chuck is tightened on drill? I have often done it, but did not find any apparent benefit therefrom. This chuck is made by A. F. Cushman, a maker of some repute on this side of the 'herring-pond,' but I have not noticed it in any of the English catalogues; probably others have had a similar experience to mine in using it, and the chuck has been dropped." [Messrs. Churchill and Co. keep many of Cushman's chucks in stock, but I do not know why this one is not among them.—ED.]

LETTERS RECEIVED UP TO MARCH 9.

A. S. (*Battersea*). Reply to your query not yet received. M. C. D.—Reply received too late for insertion.

GROOVED BARREL; P. E. M.; J. S.; FARIDA; R. W. W.; N. NOTTOC; OLD SAW; DITHE (*St. Petersburgh*); H. C; H. H. D. B.; G. EDWINSON; KING TOM; PIRIE (*South Africa*); H. W. B. B. (*St. Helena*); H. K. (*Tadcaster*); RUDDYGORE; M. C. D. (*Hull*); S. M. L. (*Goderich, Canada*); T. E. B. (*Eastbourne*).

SAW-SHARPENING.

By LOIDIS.

NOT having seen an article on the above subject in "Ours," and thinking that one would be of service to those of us whose hobby is to turn his hand to the craft of the joiner, or, as he is called down South, the carpenter, I proposed to the Editor to write one, and the result will be found in the following lines.

I shall endeavour to be as brief as is compatible with being explicit, so as not to weary the patience of my readers, if any such there be; and so I shall commence at once without any further preamble.

The tools required are very few and inexpensive, being a vice, as Fig. 1; a tool for "running down," as Fig. 2; a saw-set, as Fig. 3 (or any other form); and three or four single-cut triangular files of various lengths.

The vice and runner down may be home-made, though the former, made of iron, may be had at most toolshops; but I have never seen one of the latter for sale.

I think Fig. 1 will need no explanation, except that it should be made of hard wood, as birch or beech, and that the drawing is one-sixth full size, or on the scale of 2 inches to 1 foot, as is also Fig. 2, which is composed of a piece of hard wood 9 inches by $2\frac{3}{4}$ inches by 1 inch, though these dimensions may be varied at pleasure; a flat file 7 inches or 8 inches long, with the tang broken off, and two pieces of hoop iron about $\frac{5}{8}$ inch wide and the length of the piece of wood; the file is to be driven tightly into a groove in, and perfectly square to the face of, the wood; the pieces of hoop iron are also to be driven tightly into grooves situated as shown, so as to project $\frac{1}{8}$ inch.

"Running down" plays a very important part in putting a saw into good order, being as important in my estimation as setting; for if a saw is never run down, some teeth will be high, some low, some big, some little, or "as if the rats had eaten it," and the most prominent will do all the work; whereas all the teeth should be exactly the same height and size, so that all of them will cut.

The running down tool is applied by placing it on the saw with the file on the top and the stock on the left side, and moving it from end to end until the file has touched the points of all the teeth, thus making them perfectly regular.

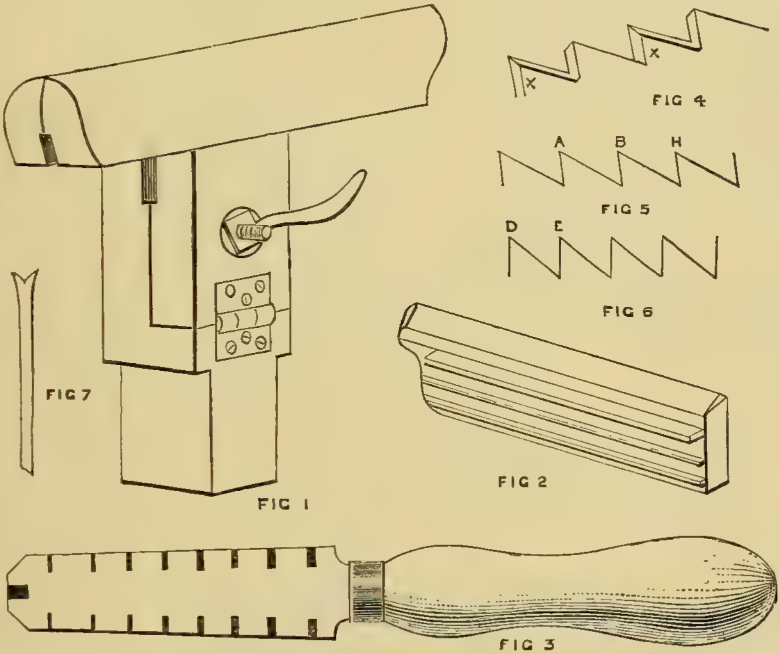


FIG. 1.—VICE FOR SAW-SHARPENING. FIG. 2.—TOOL FOR RUNNING SAWS DOWN. FIG. 3.—SAW-SET. FIG. 4.—MODE OF SHARPENING SAWS. FIG. 5.—FORM OF TEETH OF RIP-SAW. FIG. 6.—FORM OF TEETH OF ORDINARY SAW. FIG. 7.—END VIEW OF SAW SHOWING SET.

Having run the saw down, the next performance is to "set" it—that is, to bend the teeth alternately to either side, so as to make the "kerf" or "gait" rather wider than the thickness of the saw, so that it will work freely. Fig. 3 is a half-size representation of the old-fashioned saw-set; but there are many forms, though I still prefer the old style. "Cast's Patent Amateur's Saw-set," mentioned in "Notes on Novelties" (in page 351, Vol. IV.), I consider to be a very good one. A very easy and good way of setting a saw is to lay it on a piece of hard wood, and with a punch and hammer gently tap each alternate tooth, and then turn it over and do the other teeth likewise, taking care to make all the blows of the hammer of the same force. Great care is required when using the ordinary saw-set to avoid breaking the teeth out; and if the saw is of hard temper this is very difficult. The teeth should all be bent exactly the same distance.

Having got the saw "run down" and "set," we will proceed with the sharpening proper, the foregoing

processes being only preliminary. For this we shall require a triangular file, the length of which depends on the kind of saw to be sharpened—2½ inches for dovetail, 3 inches for tenon and panel, 4½ inches for ordinary handsaw, and 5½ inches for rip-saws, are about the right sizes. Put the narrow end of the saw in the vice, with the teeth about ½ inch above the top of the jaws, and—*always beginning at the narrow end or point of the saw*—file the teeth which are bent away from you till they show a point, as Fig. 4. The teeth marked with a cross are those we are considering. The file should be held with the handle about ½ inch lower than the point, and about ⅓ inch nearer to the point of the saw, if it is a 4½ inch file; shorter or longer files at the same angle. When you have filed all the teeth bent away from you, turn the saw round and do the others, which will now be bent away from you, always holding the file so as to make the angle formed by the front of the tooth and the edge of the saw (in Fig. 5 the angle A C B; in Fig. 6 the angle D F E) the same in the same saw. This angle should be in rip-saws (Fig. 5) about 95°; in all other saws (Fig. 6), except those devoted especially to cross-cutting, which an amateur is not likely to possess, about 85°, or rather greater and rather less respectively than a right angle. The greater this angle the keener the saw, or the more "hook" it is said to have.

Some joiners sharpen their saws so as to make the angles A C B and B G H almost equal; but saws sharpened thusly require greater pressure to make them take hold of the wood; and another thing, the saw brings more sawdust on to the top of the wood, thus obscuring the mark.

The following are the number of teeth per inch of the various kinds of handsaws: Rip-saw, varying from 4 at the point to 3 at the handle; ordinary handsaw, 5; panel or "fine-tooth" saw, 8; tenon saw, 11; dovetail saw, 17.

I find saw-sharpening a rather difficult process to describe, and I think an hour's showing would do more good than a whole bookful of description; but showing is not always to be had.

If I have not made any point clear, I shall be happy to endeavour to explain further through the usual channel.

In conclusion, I hope that all who read this article who have been troubled with their saws will be assisted to sharpen them, so as to save themselves a lot of "hard labour."

[It will be useful to point out that some remarks on Saw Sharpening were made by Mr. A. W. G. Tayler, C E., in Vol. I., page 501, in his papers on "Wood-Working Machinery for Amateurs." No special article, however, has appeared before on this subject.—ED.]

PATTERN MAKING FOR AMATEURS.

By ARTHUR J. SCOTT.

VI.—PULLEYS (*continued*).

HAVING in my previous article promised a fuller description of the method adopted in making a pulley arm core-box, I fulfil my promise in this paper by description and sketches herewith given.

Though one of the sketches is of a medium size rope pulley, I am not supposing that any of ours will ever have to make one with the number of grooves shown; but the reason it is given here is for the better instruction of the amateur, to show him how these castings are made, so as to be able to better apply the knowledge to the various pulleys, etc., he would require to make, which, if I can get him to thoroughly understand the moulding of the one under consideration, he will be all the more able and proficient to do anything he might undertake. Of course, in the present sketch given, it may suit many who, like the writer, dabble in other crafts besides his own, practically, and, I might say not the least, financially; so I will give an instance where it could be utilised with much saving of cost.

Take the case of a mill-joiner, a man who can use his tools. Isn't he an amateur when he comes to pattern making? Of course he is; and we can make amateurs in this way unlimited, whom the following special article on rope pulleys will much benefit. For myself, I find it hard to draw the line between pros. and amateurs, for when a man practises at any other craft besides his own, he must be, in my humble opinion, what is called an amateur at that craft; for he can't be a pro., as he does not get his living with it; and if we take the last as anything to go by, then we must, as I say, all be amateurs in some way or another.

I have purposely digressed on this subject in order to show some of the difficulties which we encounter when we come to speak of amateur and pro. It cannot be told by quality of work, for sometimes we see a splendid piece of work executed by So and so, who never worked at the trade in his life. For example, I will take a noted medallion turner, Jethro Rowe, of *Darwen*, now living, and who, not so long ago, was a paper manufacturer. He now, and has for long years, held his place in the foremost rank of medallion and fancy turners. This man, you see, was an amateur, and if it makes a man a pro. after he has served an apprenticeship to the trade, why, then, this man must be an amateur yet. I must now apologise for taking up space on this subject, but it is one of very great interest to me, and, perhaps, is to many more besides me. Of course, it must not be forgotten

that the above is only the writer's humble opinion, and not everybody's.

I must now to the subject of this paper under consideration, which will be pulleys, as was the last; but, you see, when we come to speak of pulleys, we find so many different kinds that I am only able to touch on those in most common use, and within the ordinary amateur's ability to construct.

The most important part of the pattern we are considering is the arm core-box, represented in full at Fig. 92; the other figures show complete details of all I believe the amateur will require in making the box. Of course, if the pulley is not over a couple of feet or so in diameter, it would be best to make a whole pattern, which, however, shall be next described (one way of making having been done so in our last).

However, in Fig. 92, I must first draw our amateur's attention to the box sides, and for supposition I will suppose the sketches to be on the scale of 2 inches to the foot, which will make the complete rope pulley shown in Fig. 86 to be a 40 inch pulley, that is, reckoning to the centre of the ropes in the grooves. The box sides under consideration then will want to be in length 1 foot 9 inches and 1 foot 8 inches respectively, and the width 14½ inches, *exactly* parallel the complete length. In looking at the figure, you will perceive the side A at one end is rabbeted into the side B, afterwards being screwed fast from the outside, as at D.

Our pulley having six arms, and each core made from this box having to be a complete and exact sixth part of the circle, the sides of this box will want to run exactly to the centre of the pulley; and whatever part of the sides tangents are struck, these points at the inside edge of the sides will want to be an exact sixth of the circumference. The following method is the simplest plan of getting the desired result:—

At C, Fig. 92, is about a ½ inch hole, bored by a centre bit, perhaps about 1 inch deep, and a hard wood plug filling up the cavity made, after to nicely level off to the same plane as the sides. Now, putting a small straightedge level with the inside of sides, draw intersecting lines on plug inserted. Do this on both sides of the box. Now where the lines intersect will be our amateur's working centre, which he will constantly use in making the box; hence, the reason of hard wood being inserted.

Perhaps some of ours might be a little puzzled to get the proper angle to plane the end marked D, and to them I will submit the following:—

If you are not in possession of a good set square in your workshop, get one made. I believe you would never regret the time spent on one; and at the two edges, at right angles, gauge two lines, which will also be at right angles, having been made parallel with the outside edges. On the line gauged at the point of intersection with the other, describe a circle of any diameter that you can compass easily into the face of the set square. From one of the right-angled lines describe arc, radius of circle described, which will represent 60°; and from the other line an arc or point described will represent 30°; all complete 90° being a complete quarter of a circle, which, being exactly a quarter of 360°, proves the other lines drawn to be at right angles. Next finish dividing on segment of circle into divisions of about 5° each, which, when finished, you will find handy for getting the angle or bevel for anything you may wish to make.

Our box being a sixth, our angle of the side A will want to be the same, and 60° being one-sixth of 360°, we set our bevel to that, and work the end of our board accordingly. The other end is simply squared up in the ordinary way of working. Next, to keep the sides perfectly rigid and immovable during the fitting of the curve segment, you will want a couple of odd ends of scrap long enough to reach across the sides, at about 4 or 6 inches from the bottom, loosely fastened by sprigs, or, what is much better, screws, until the segmental curve forming rim is finished and fastened into place, which will next claim our attention.

In looking at the complete pulley in Fig. 86, you won't find any unnecessary metal wasted in the rim, which I hardly need say ought not to be the case, but which we see in so many of these pulleys manufactured. At first sight the corrugated face appears a little difficult to mould, but on examination this soon melts away.

We will now refer to the arm box, Fig. 92, and you will notice in the sketch two hand nuts, shown at either end of segment on the outside edge, of which the use and reason will now be explained. In making the arm cores out of this box, our moulders would not like the segment screwed on, as the screws are not so strong, or so easily detached as the hand nut shown at E, Fig. 92. The bolt belonging to the nut is shown fuller in Figs. 99 and 99A. The tang shown on one end of bolt is to be mortised into the sides, as shown in Fig. 92, its purpose being to resist the strain given by the hand nut E.

To consider the rim segment more fully, I must tell our amateurs that it is built up out of segments, shown more fully in Figs. 100 and 101; the method of procedure being to put two segments, then three, then two, and so on, in alternate numbers, the end joints of each piece being jointed on a shooting board, and fairly bedded on the one underneath, afterwards gluing and screwing well all together.

Having got all well fastened and secure, we can now proceed to cut the rabbets as shown at F F,

Before doing this, however, perhaps it would be better to test one edge, to see whether correctly straight or not, which it must be. If it is not, I must insist on this being attended to first. Now, with a scriber, mark the position of the sides upon it, rabbet, and make a good fit. Now put a screw into each end to fasten to sides temporarily, afterwards fitting the bolts already spoken about. In Fig. 98 we have a sketch of a plain plate, which will be screwed on outside of rim segment at G G, Fig. 92. These plates form a bed for the hand nuts to work against.

We will now suppose our segment fitted, and the inside edge being well over the required finished line. Now, with our trammels set at the correct radius, we can describe arcs on the edges, the edges having been previously dressed level with the edges of the sides, taking care to always use a trying plane for such work as this; indeed, it is much better to use this wherever practicable, as it ensures your work being so much straighter. We will now suppose the sides made, and rim segment fitted. The next thing to do is to work the rim to the curve described by the trammels. The best way to do so is to roughly gouge away all stuff almost to the line, and afterwards finishing with an iron spokeshave or skipjack smoothing plane.

After the segment is finished, we come to the corrugated part of rim. To do this you will require as many pieces of wood as grooves, working to something like the same shape shown in Fig. 89, and to bend the pieces inside of segment. You will require to saw-kerf them at suitable distances, which you will be able to accomplish after a little practice. Before nailing these, however, to rim, we ought to finish the arm. As you will see from Figs. 95 and 96, it is divided into two different parts, technically termed the head and tail end. The head end is shown in Figs. 95 and 96, and if too thick to make from one thickness, joint another piece to it, being careful to keep joint in centre of arm. The joint line will also be very useful to you, as it can be used during the progress of the arm pattern for a centre line. Perhaps it would be better to make the tail end of arm first, shown very plain in Fig. 92, and the method of setting out at Fig. 94; A, being a block of the thickness between the joint of arm and rim, and the length and width taken from the size at the bottom of curve. Perhaps a little advice may not be out of place here. In whatever job you are doing, always have centre lines scribed on all round, and in setting the dimensions out, always work from your centre line. In this case having your centre line already scribed round, and using this as a centre, scribe the radius as given from B to C, Fig. 94, this being the radius of your rim segment already worked.

Having marked centre lines on rim segment, bring your block centres over these lines, and fit the block on segment, bedding it all over with chalk, which, being done, set out on top of block the section at A B of arm, Fig. 92, and on bottom describe same section, and afterwards describe width of hollow all round, as shown in Fig. 94A; C being section at top, or rather plan at top, and B being plan at bottom.

To work this block, you will require a rough block, such as shown at D, Fig. 94, screwed into curved block, A E being the screw, by this means you will be able to grasp D into the ordinary bench screw, and carve it out all round, the manner of doing so is to rough it out with an ordinary gouge, and afterwards with a paring gouge of the correct sweep; work accurately to a templet made after the same manner as the one in Fig. 93A. The tail end being finished so far, it will perhaps be as well now to go on with the body or head part of arm shown in Figs. 95 and 96. The cheapest way and quickest is to get your timber out the width between the dotted lines, A A, gluing the corners C on afterwards; after having glued up and planed to thickness, you strike a line down centre of arm from D to B, and set out angles on each side to sides of core box, afterwards planing up and making a good fit; you now loosely sprig the tail-piece to rim, and set your trammels to the edge next to body of arm; now take the tail-piece out and put the arm in, scribe the end and square off, allowing about three-quarters of an inch beyond for the supporting piece C, or this can be screwed on afterwards, it is optional. You will also require a slot cutting out of the tail-piece to suit.

The purpose of the supporting piece being as the name purports, to support the arm whilst in the box during moulding; to work the arm you will require templets, making as Figs. 97 and 97A, which is one half of an elliptical figure; the bottom edge A you will see is required to come to the joint line already spoken about. To describe a true ellipse look in any elementary geometry, and you will find several methods, failing that, strike it out with arcs of circles; and, possibly in my next, I will describe several useful ways of describing elliptical circles and curves, as they might possibly be of much service to amateurs in general, "amateur pattern makers included." In commencing to work this arm, you will fasten it in your bench screw, and cut away at the part E to the larger templet shown at Fig. 79A, doing one-half at once, cutting away with gouge and chisel until your templet beds evenly all over. To know whether it does this or not, there are several ways adopted: first to rub the templet with chalk, which is very good so far as it goes, but you will find the edge of your tools gone very quick; the second is with what is vulgarly called "riddle-

raddle," which as almost everybody knows,* is a small red soft stone, found in brooks and elsewhere picked up during a walk ; to use it, you wet the stone with spittle and rub it on the templet, which being rubbed in you will find this mark well and not make your tools dull, therefore adopt it.

After doing both sides at the part E, cut or bevel all surplus stuff off at the end of arm portion, then

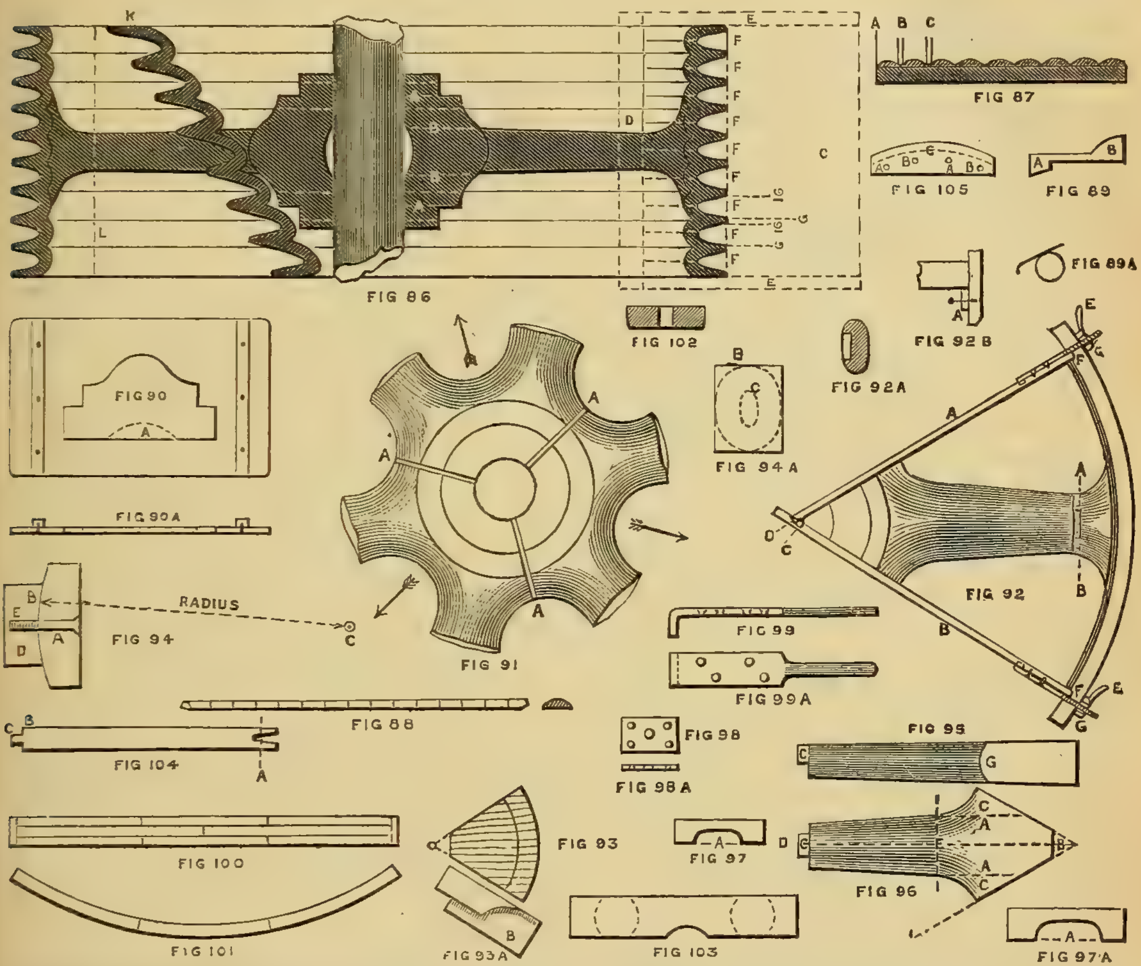


FIG. 86.—CROSS SECTION THROUGH ROPE PULLEY. FIG. 87.—DITTO THROUGH RIM SEGMENT. FIG. 88.—LONGITUDINAL VIEW AND SECTION OF CURVED PIECE, SHOWING SAW KERFING. FIGS. 89, 89A.—TEMPLET FOR ROPE GROOVE, AND VIEW SHOWING ROPE IN GROOVE. FIGS. 90, 90A.—CORE BOX FOR SPLIT PARTS IN BOSS. FIG. 91.—PLAN OF BOSS SHOWING CONTRACTION. FIG. 92.—PLAN OF CORE BOX FOR ARM. FIG. 92A.—SECTION OF ARM. FIG. 92B.—ARRANGEMENT OF LETTING ARM IN BOSS. FIGS. 93, 93A.—PLAN AND ELEVATION OF BOSS SEGMENT. FIGS. 94, 94A.—SETTING OUT OF TAIL END, OR RIM END OF ARM. FIGS. 95, 96.—PLAN AND ELEVATION OF ARM. FIGS. 97, 97A.—TEMPLETS FOR DITTO. FIGS. 98, 98A.—BEDDING PLATE FOR NUTS BELONGING TO ARM BOX. FIGS. 99, 99A.—PLATE AND BOLT BELONGING TO ARM BOX. FIGS. 100, 101.—ARRANGEMENTS OF SEGMENTS FOR RIM. FIG. 102.—SECTION OF PRINT. FIG. 103.—PLAN OF LOAM BOARD. FIG. 104.—PLAN OF GAUGE STICK. FIG. 105.—PLAN OF TEMPLET FOR CUTTING TIMBER FOR CORES.

turn on the article, working shows all points touching templet ; the third and last, and I might add best, is a halfpennyworth of heelball, as soft as you can get it ; take your heelball and rub a black line all round at the parts, correct to templet, then afterwards take away all surplus stuff between the two lines, using a straightedge to work it accurate. The best tool to finish is a stop plane, with the iron set very fine ; for the curves at C, you will require to carry a line from C to F, and find a point on this line where you could strike

* I am afraid "almost everybody" does not know. For example, the name and the stone are both unknown to me, though the name bears affinity to "reddle" and "ruddle," terms which are synonymous with "red ochre."—ED.

a semicircle with the lines touching the sides of arm, edgewise; you would work the arm to the curve G, letting this curve die away to the elliptical form of arm at the dotted line E; you may now fasten the tail curved piece to rim segment and drop the arm in its place in the box, on no account must you screw the arm in the box, for the moulders work this loose. The manner of setting the arm in correct position is shown in Fig. 94B; you first gauge the thickness of arm on box sides, and on one pair of lines (the bottom pair) you nail two loose strips, as shown at A, Fig. 92B; you may now lay the arm on these strips as shown, and commence work on the bosses; perhaps, however, it might be better to entirely finish rim segment now, which we have been unable to finish before on account of waiting for arm. The curved pieces I have already given instructions for making; the distance of saw kerfs are, as I have said, to be according to radius of rim and curve best found out by practice. You may either screw or nail them on, it being optional.

However, before fastening in, place gauge lines along rim segment as at A, B, C, Fig. 87, etc., and set the curve pieces to the lines; of course, in fastening on, it is best to have the rim detached.

Having now finished the rim and arm, we next turn to the bosses which we show detached in Figs. 93 and 93A; they are merely pieces cut to the angle of box, and thickness from lines A to B in Fig. 86, with a hollow worked round, exact to templet B, Fig. 93A; on the top of these you screw a piece the thickness from A to outside, Fig. 86; these pieces are a continuation of thickness of boss, and their purpose is when the pulley is cast to put a wrought-iron hoop round to strengthen the boss. You may screw these in box. I must here explain one of the peculiarities of casting pulleys or wheels, except of small dimensions; you will notice in Fig. 91 that the boss is split in three different places, the reason being if not split, the arms would during contraction of the metal, crack or become separated from each other; in the way shown, however, the arms will contract in pairs, thereby escaping elongation in some parts and deflexion in others; and now the contraction will be in the direction of the arrows. To be able to effect this, we shall need a core box, as shown in Figs. 90 and 90A; one showing plan and the other an edge view; the space in centre is exactly the same section as the splitting part, except at the part A, which is carried straight in order to cut a slot in main core to carry this core in a perpendicular position in the mould. At either end of box, it is strengthened by small battens, the plate itself not needing to be above a quarter of an inch in thickness.

In addition to the foregoing, the moulders will require a core print, gauge stick, and loam-board for core. In regard to the first, I show a sketch at Fig. 102, which is the diameter of core required, with a shade of strip in it, and about one inch and a half or three-quarters in thickness; in the centre, you will require an inch and three-quarters round hole to drop over centre spindle in mould (moulders generally use this size). Perhaps some would like to know a little more about the centre spindle than what I have given; for their information, then, I will say that the moulders in commencing this mould dig out a hole for it in the sand, and the very next thing they do is to put a spindle in the sand, making it tight and firm; this spindle is set plumb, and a level bed is then struck up by means of a board revolving round the spindle; but our amateurs would not need to supply this, as every foundry has a good supply. Having struck a level bed, the moulders lay the arm cores in position on the bed, but to be able to do this we are compelled to come to the second item, viz., a gauge stick, of which a sketch is given in Fig. 104. It is made from a piece of pine about ½ inch thick, 3½ inches broad and a couple of inches longer than the outside radius of pulley; at one end you require a longitudinal slot, the width being equal to diameter of spindle, the centre being at A, and from A to the edges B is the radius of the arm cores, *i.e.*, equal to the radius of rim segment; from B to C is the thickness of metal and groove, *i.e.*, to the furthermost edge from the centre of pulley, the slot first on the spindle, and the board rests on core which is set to the tenon end of gauge stick. In regard to the loam-board, I show a sketch of it in Fig. 103. The method of construction I believe I have described in a previous paper. It is merely a board about one foot longer each way than the core required, one edge being bevelled to escape the loam; in making these boards, the size or diameter of core must never be omitted to be marked on, as it is the only guide for the size required the core maker has. These minor points being well attended to the result need not to be feared for.

The last box remaining to be considered is the groove box. At a casual glance it looks the most difficult box of the set to make, but really it is not any more difficult than any of the others, for it is but a repetition of the single groove box before described, but with the alterations of a number of grooves. For construction, I must refer our amateur to the previous article on a flywheel, the rim core-box being made in the same manner as the box part belonging to the one about to be described. Referring to Fig. 86, C shows the end, E E the sides, and D being a couple of strong battens to keep all the groove segments from shifting during the making of cores. The number of cores to make up the circumference is optional, but I would say in the present instance, about eight or nine cores. To obtain a ninth part of the circumference you take a sixth and

divide that into nine parts, then take six parts of the nine, and set your trammels to this distance, and you will have one-ninth part of the circumference for this; and other divisions not generally explained in works upon geometry I will explain fully in my next article.

Having decided on the number of cores you are going to employ to make up the circumference, which, by the bye, should not be over two or three feet long, about two feet four inches being a nice length, you make a templet to cut out your timber by, it should be thin stuff, about $\frac{1}{4}$ inch being thick enough. The thickness of your stuff will be the distance from F to F, or the centres of the ropes in Fig. 105.

I show a small view of the templet; A A are your screw holes for one piece, B B for the next, and so on alternately, by doing this you always keep clear of your screws in working; C shows the line at bottom of groove. In construction you cut out roughly to templet, not forgetting the working margin all round; you joint and screw each together, using templet as guide for screws, after jointing all up you scribe a centre line all round, and with your templet its centre line coinciding, you scribe all round, marking well in after with a fine blacklead; you next plane and work to lines described, having done this, you gauge lines as G and H all across the width, and at the joints F at each end set out the grooves; you may take it all to pieces again, only minding to keep the same screws in their respective holes; and now you may commence to work the grooves. In Fig. 89 is a templet which you will require to work them; the method adopted being to remove all surplus stuff away with an outside gouge (by saying outside I mean ground outside), and afterwards finishing with rabbet, and about a number four round. The manner of using templet is to work all stuff away to part A by gauging a line with a cutting gauge and using a rabbet plane afterwards in finishing, use the part B, testing it correct, by rubbing templet with heelball.

Fig. 89A shows an enlarged view of rope in position, showing more clearly the two different angles in the groove. By using two different angles you dispense with a little metal which you would be forced to have, otherwise, thereby it lightens the pulley a little.

This description would also apply to a speed pulley; for a lathe of varying diameters the method of construction, not differing much in detail, the chief difference being in the groove box, shown at L, Fig. 86, thereby entailing a broad base to core K; shows section of groove. Any other particulars not here foreseen, I will be happy to supply to Amateurs in Council.

(*To be continued.*)

HOW I FURNISHED MY SNUGGERY.

Being Part III. of "My Furniture, and How I Made It."
By MARK MALLETT.

II.—MY BOOK-SHELVES.

THE snuggery of a man of my tastes and habits must necessarily have accommodation for books and "curios," and my next care was to provide a proper place for such things. To dispose comfortably of my small library was my chief object; but I had collected certain other matters, for which also I proposed to find room on my book-shelves.

The breadth of wall-space at my command was 5 feet 6 inches, and I proposed to carry my work to a height of 6 feet 10 inches—that being as high as people generally care to reach, or can conveniently do so. The elevations (Figs. 8 and 9) will give a general idea of my plan.

It will be seen that the pile of shelves is divided into two parts—an upper and a lower—which are, for convenience both of construction and of removal, quite separate. The upper part, beside the spaces for books, has at each end a series of corner nooks, designed for holding old china; the top, also, is a shelf for displaying examples of the same; whilst in the centre is a recess fitted with small shelves intended for minor objects of curiosity. So also in the lower part. Among its larger book compartments are two nests of small drawers—one in view and the other secret—which I contrived as receptacles for my modest collection of old coins and medals. The recess and nests of drawers I give in the plans as I made them, for there are, doubtless, other amateur workers who will have the same need for them as myself; yet, should any reader prefer to omit them, and give the space which they occupy also to books, he can do so without having to face any unexplained difficulties, and will, indeed, avoid some of the most difficult and delicate work in the whole affair.

Although shelves which can be raised or lowered at will have their advantages, I did not adopt any arrangement of this kind in my bookcase. I considered that by using fixed shelves I could make a very much stronger piece of furniture, and at the same time dispense with much care and nicety in framing it together. These were points of importance when skill and appliances were, as in my case, limited; and, moreover, if the proportions in which the different sizes of books commonly occur were duly weighed beforehand, it seemed quite possible to make fixed shelves answer every purpose required.

How I arranged my spaces will be seen in the elevation (Fig. 8). At the bottom is a central space 18 inches high, for folios—which in collections of

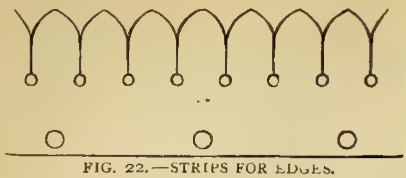


FIG. 22.—STRIPS FOR EDGES.

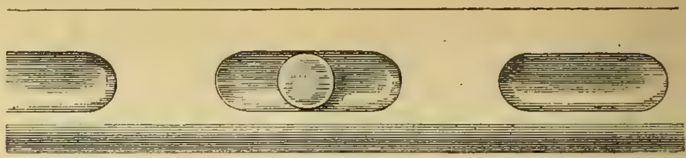


FIG. 20.—CORNICE.

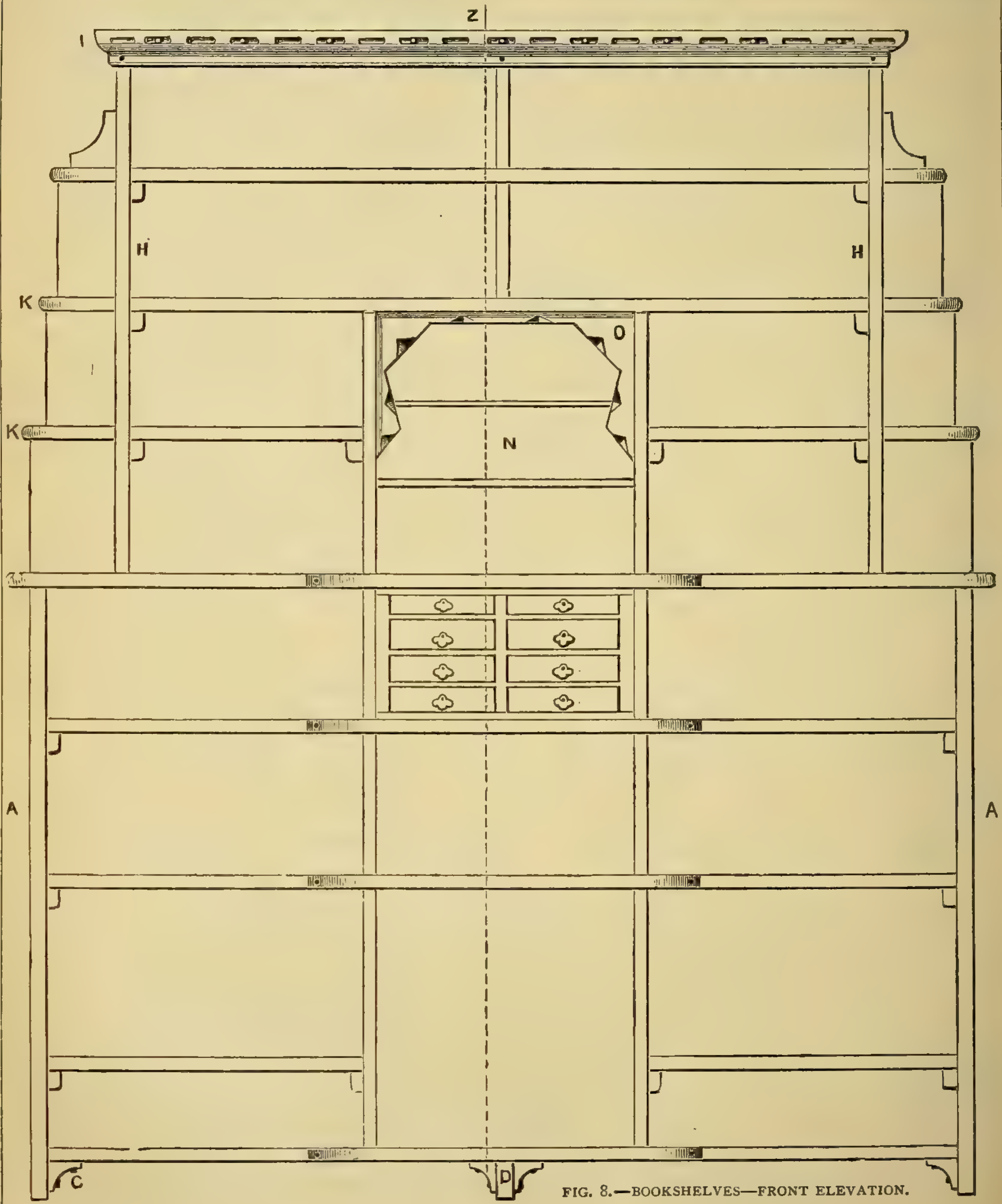


FIG. 8.—BOOKSHELVES—FRONT ELEVATION.

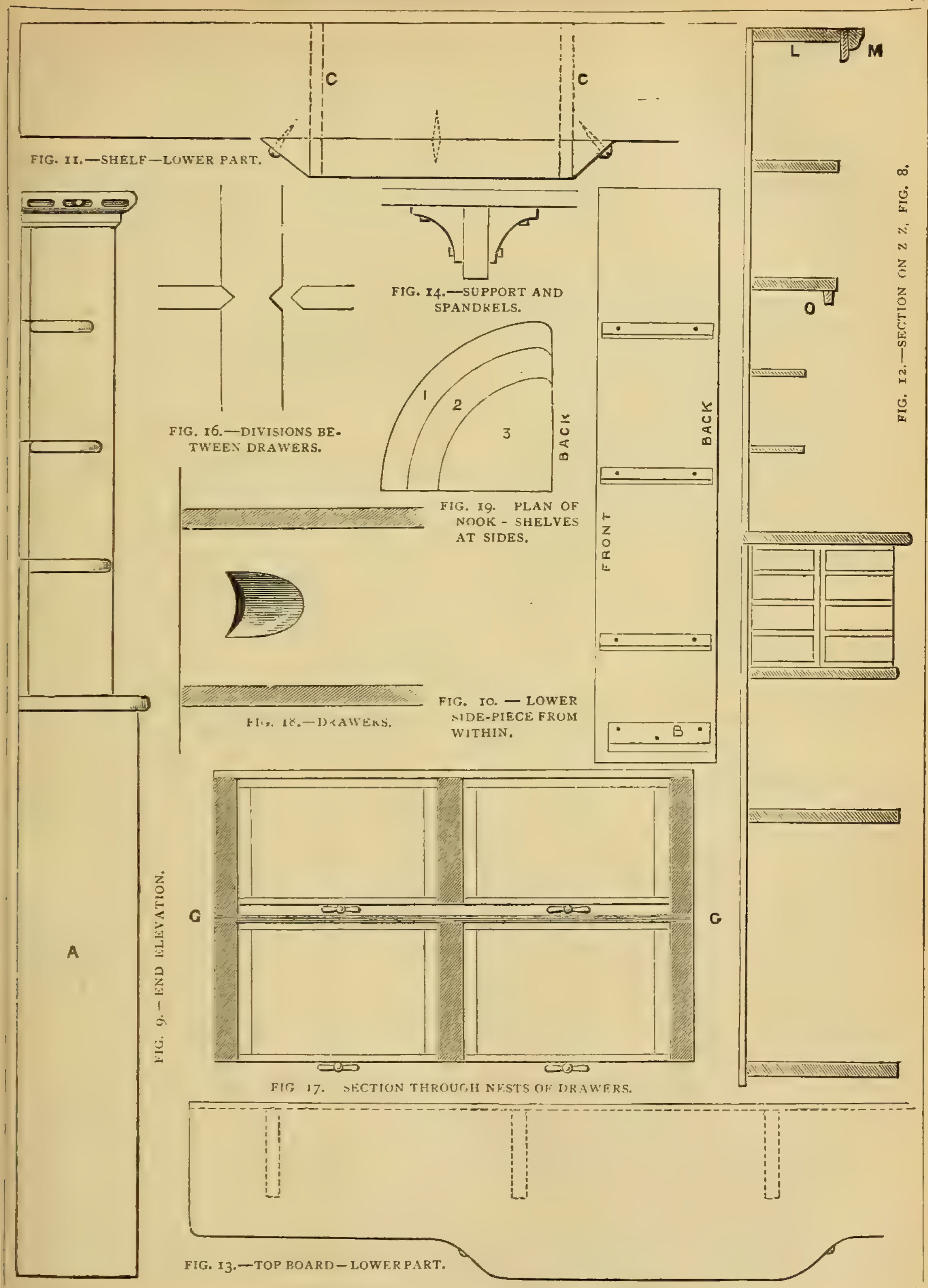


FIG. 11.—SHELF—LOWER PART.

FIG. 16.—DIVISIONS BETWEEN DRAWERS.

FIG. 14.—SUPPORT AND SPANDRELS.

FIG. 19. PLAN OF NOOK-SHELVES AT SIDES.

FIG. 18.—DRAWERS.

FIG. 10.—LOWER SIDE-PIECE FROM WITHIN.

FIG. 12.—SECTION ON Z Z, FIG. 8.

FIG. 9.—END ELEVATION.

FIG. 17. SECTION THROUGH NESTS OF DRAWERS.

FIG. 13.—TOP BOARD—LOWER PART.

modern books will always be but few. At the base of this, on either hand, are two shallow openings, in which magazines, illustrated papers, etc., may be *laid.* Above these are compartments 1 foot high for large quartos: in these ample head-room will be found for such volumes as AMATEUR WORK, when bound. Higher, the shelves are adapted for the octavos and books of smaller size, which form the chief part of the libraries of most people at the present day.

Since large books require extra depth as well as extra height, the centre of the lower part is made to project further from the wall than the wings. It projects 1 foot, whereas they project 9 inches only; and this greater projection, beyond accommodating the folios, gives sufficient depth for the double nest of drawers, of which more will have to be said hereafter.

The upper part is intended generally for lighter volumes, and is allowed a projection of 7 inches only. As the lower part has a topboard which overlaps the books below some little distance, it will be seen that at a convenient height—3 feet 8 inches from the floor—I have a long shelf in front of my books, which in my small room comes in handy as a place on which to set many odd things, and gives an additional value to my bookcase as a piece of furniture. The end and central widths of this shelf appear in Figs. 9 and 12.

I made the lower and simpler part first. Of this the upright side-pieces (marked A in Figs. 8 and 9) are of inch wood, 9 inches broad and 3 feet $7\frac{1}{4}$ inches high. They are quite plain. Fig. 10 shows the inner side of one of these pieces, with the arrangement of ledgers upon it for the support of the shelves. Of these ledgers, the lower one (B, Fig. 10) is of inch wood, and 2 inches deep; the others are of $\frac{3}{4}$ inch wood, and only 1 inch deep. All of them are strongly screwed to the upright with flat-headed screws. Their ends towards the back are kept half an inch from the edge, to leave room for the backboards. Towards the front they approach the edge more nearly, except the lower one, which is kept an inch distant, to leave room for the spandrel (C, Fig. 8), by which it will be covered.

As seen in the front elevation, the ends of the ledgers show, and are unsightly; but it must be remembered that in the finished work this will not be the case. This diagram shows the woodwork only; when completed, the edges of the shelves and a sufficient space beneath them will be hidden by scolloped strips of American leather-cloth.

These ledgers will perhaps strike the reader as open to another objection—namely, that wherever they occur they diminish the head-room for books by an inch. This is true; yet in practice I do not find it any serious inconvenience. It is always easy to find a volume for the end place a trifle shorter than the others which are to occupy the same row, and the strips of leather conceal any slight difference in height.

To these ledgers the ends of the shelves are screwed down with flat-headed screws, and care should be taken that the counter-sinking is deep enough, lest the heads, by sticking up above the level of the shelves should scratch the books. Reference to the elevation, Fig. 8, will show that an additional pair of ledgers, 3 inches longer than those drawn in Fig. 10, will be needed to support the inner ends of the two short shelves in this lower part.

The shelves in this part—three long and two short ones—are $\frac{3}{4}$ inch wood, and are of a general width of $8\frac{1}{2}$ inches. Of the short shelves this is the width throughout; but the long shelves, which have a length of 5 feet 4 inches, and reach from one side-piece to the other, are of this width in the wings only. In the central part they are widened by a 3-inch strip, as will be seen in Fig. 11, which gives a sufficient portion of one of these shelves. It will also be seen in Fig. 12, which being a vertical section on line Z Z, Fig. 8, cuts through the central and wider portion of the lower part. Fig. 11 shows the shape of this strip, and the manner in which it is secured to the front edge of the shelf—namely, by a dowel about its middle and a round-headed screw at each end. The short upright pieces which reach from shelf to shelf, and whose place is indicated by the dotted lines at C, C, in Fig. 11, also help to keep these strips fast.

Of these short uprights we have in this lower part three pairs, the heights of which are respectively 9, 10, and 18 inches. They are of $\frac{3}{4}$ inch wood, and are $11\frac{1}{2}$ inches wide—that is, they, like the shelves, do not extend so far backwards as the end-pieces by half-an-inch, in order that space may be left for the backboards, which will be half-an-inch thick. The lower pair of short uprights are screwed to the shelves both above and below; the middle pair are dowelled to the shelf below and screwed to that above; whilst the upper pair are dowelled to the shelf below and screwed to the topboard.

The topboard (Fig. 13) is like the shelves, of $\frac{3}{4}$ inch stuff, and it overlaps them 1 inch along the front, and $1\frac{1}{2}$ inches at the ends: its measurements are, therefore, 3 feet 9 inches long, by 13 inches in its wider, and 10 inches in its narrower parts. The edges at front and ends are neatly rounded off as shown in the elevations and section. It is screwed down to the four uprights. The dotted lines in Fig. 13 indicate where the upper part of the bookcase will rest on this board.

As the bearings from end to end would be too

long to carry the weight of the shelves properly when loaded with books, a central support is provided, as shown at D, Fig. 8. This is merely a strip of inch wood running from front to back, and screwed to the lower shelf. To each side of it are screwed spandrels. The support with its spandrels appears on a larger scale in Fig. 14. The two end spandrels which are screwed to the side-pieces are just like these: all are of inch wood, and add materially to the strength of the bookcase.

The back both in this and the upper part is of half-inch match-boarding, placed vertically, and screwed to the back edges of the shelves and short uprights. As shown in Fig. 12, the ends are brought slightly below the lower shelf, that the screws along the bottom may have a firmer grip; the lengths, consequently measure 3 feet 5 inches.

The construction of the nests of drawers has next to be considered. A reference to Figs. 8 and 12 will show that the space occupied by them is 18 inches wide, 9 inches high, 11 inches deep. As before hinted, these nests were in the first place designed because I wished for a number of small, shallow drawers to hold a collection of coins. Now Roman bronze money, and more recent copper coins and tokens, are of small intrinsic value, and offer no attraction to thieves. There is no special motive for placing them in a place of safety. Where books and china may be left exposed, they will be in no danger. But it is not so with examples in the precious metals. For them a place of security was needed, and hence my idea of a second nest of drawers, whose existence none but those who were in the secret would suspect. My first nest was for bronze and copper, and a burglar opening its drawers and finding its contents worthless in his eyes, would not be likely to have either the time or the penetration to conjecture that other drawers containing gold and silver lay behind them. Yet my arrangement by which the first nest might be pulled out bodily, and the second either drawn forward to its place, or, like it, drawn out altogether and set beside it on a table, gave me every facility for showing my collection to my friends. It may be that some of the workers who carry out the present plans are not collectors of old coins, but may find the secret drawers useful as a safe depository for current ones—if so, it is sincerely hoped that they may have a greater number of such coins to be thus stored than have ever fallen to the share of Mark Mallett.

The ends of the first nest and the upright division are of $\frac{3}{4}$ inch wood. The first-named pieces should be just high enough to slip easily into the aperture, and the latter $\frac{1}{2}$ inch shorter. All are $5\frac{1}{4}$ inches broad. The top and bottom are of $\frac{1}{4}$ inch stuff of the same breadth. These are dovetailed to the ends, and screwed in place as shown at E, Fig. 15. The upright division may be simply fixed with screws as at F (same figure).

The horizontal divisions, six in number, are fitted into grooves cut in the upright pieces (see Fig. 16). These divisions are of $\frac{1}{4}$ inch stuff. The grooves and corresponding projections reach from the back to within $\frac{1}{4}$ of an inch of the front. The divisions, when the back is screwed on, will therefore be firmly fixed. The back, also of $\frac{1}{4}$ inch wood, measures 18 by 9 inches.

The upper pair of drawers are $1\frac{3}{4}$ inches deep, the others 2 inches. Fig. 17 gives a horizontal section, cutting through both nests of drawers. From this it will be seen that the ends of the drawers are of $\frac{1}{2}$ inch wood, the fronts and backs of $\frac{1}{4}$ inch; the bottoms are of $\frac{1}{4}$ inch also.

It is worth while to finish and sand-paper off the drawers neatly, since in such small matters the eye more quickly notes and takes offence at rough and careless workmanship than in larger. I found it easy to get suitable handles for the drawers, but was perplexed to find a satisfactory arrangement by which to draw out the nest bodily, since any handles, which were obviously such, would suggest the very thing I desired to conceal—namely, that the nest was made to be pulled out. The expedient on which I at last resolved was a very simple one. In the two ends opposite to the second drawers from the bottom, and $\frac{1}{2}$ an inch from the front, I cut a couple of thumb-holes with a $\frac{3}{4}$ inch gauge as in Fig. 18. These are not seen till the drawers which hide them are pulled out, when they are sufficiently accessible.

In most respects the second nest resembles the first, and it is only of their points of difference that I shall have to speak. Reference to Fig. 17 will show that the ends of both nests are of the same width; but as the handles of the drawers in the second nest require space, I made the ends to project $\frac{1}{2}$ an inch, as at G G, Fig. 17. The divisions between the drawers and the drawers themselves are therefore $\frac{1}{2}$ an inch less from back to front, $4\frac{1}{4}$ inches instead of $4\frac{3}{4}$ inches, as in the first nest. For drawing out the second nest I fixed a handle in the upright division.

The whole of the woodwork of the lower part having been described, the upper part has now to be considered. The end elevation, Fig. 9, shows that in this the upright side-pieces (marked H H, in Fig. 8) are only $6\frac{1}{2}$ inches wide; for though the projection of this part is 7 inches throughout, these pieces do not, like the corresponding ones below, go back to the wall, but are set $\frac{1}{2}$ an inch from it to allow the back-boards to pass behind them. They are 2 feet 3 inches long, and are dovetailed and screwed to the topboard above. The joining will be hidden by the cornice

(I, Fig. 8). These side-pieces, together with the short uprights, the topboard, and the shelves (except those in the recess), are of $\frac{3}{4}$ inch stuff.

The topboard, which shows only at L, Fig. 12, is of the same width as the side-pieces ($6\frac{1}{2}$ inches); so are the short uprights, and so are the shelves, those in the recess only excepted. The shelves are fixed to the uprights by ledgers in the same way as those below, and further directions with regard to them will be unnecessary. The long shelves in this part, two in number, have a length of 4 feet $4\frac{1}{2}$ inches.

The back also is boarded up in the same manner as that of the lower part with $\frac{1}{2}$ inch match-boarding. The form into which the outside lengths are cut, decreasing by an inch at each shelf, appears in Fig. 8. The lengths of match-boarding required are each 3 feet $1\frac{1}{4}$ inches.

The three nook-shelves, which are all drawn to scale in Fig. 19, fit into the angle outside the side-piece. In the diagram No. 1 is the lower, No. 2 the middle, and No. 3 the upper shelf. Along the curve their edges are neatly rounded off. As seen at K K, Fig. 8, they project at the outside $\frac{1}{2}$ an inch beyond the backboard, and the angle at that point is in consequence rounded off. These nook-shelves are fixed by screws through the side-pieces before the inner shelves are fastened down; they are also screwed to the backboard.

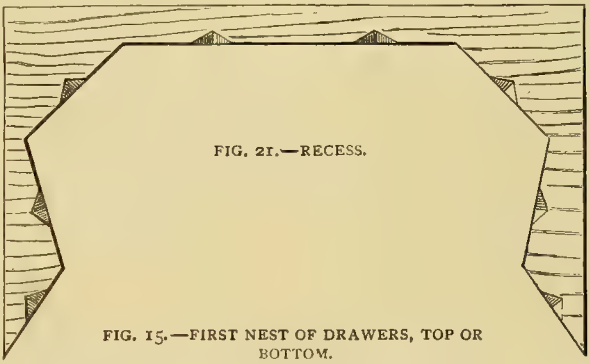
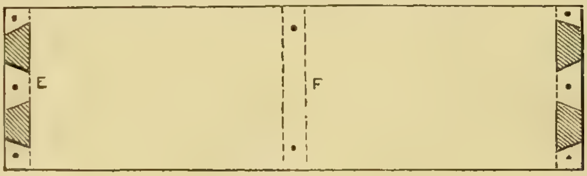


FIG. 21.—RECESS.

FIG. 15.—FIRST NEST OF DRAWERS, TOP OR BOTTOM.



As the topboard, L, Fig. 12, is dovetailed to the side-piece it has to be 4 feet 6 inches long. The cornice, M, Fig. 12, consists of two members, and the pieces composing it are mitred at the angles. The under member is $\frac{1}{2}$ inch wood $2\frac{1}{2}$ inches wide, the lower outer angle being chamfered off. The upper member is inch wood $1\frac{1}{2}$ inches wide; the form to which it has to be worked is shown in the above-named section. This strip is decorated by a line of gouge-work, simple in character and quickly cut; Fig. 20 shows this ornament on a larger scale. The cornice is fixed in place with round-headed screws.

A peculiar feature of the upper part is the recess, N, Fig. 8. At the back of this are two small $\frac{1}{2}$ inch shelves 4 inches wide. They are screwed to the backboard, and their ends against the uprights rest on light ledgers of $\frac{1}{4}$ inch wood. The ornamental piece which arches over the front of the recess, and which is marked O in Figs. 8 and 12, is of $\frac{1}{2}$ inch board. It will be seen drawn on a larger scale in Fig. 21. To fix it a couple of vertical strips are screwed to the uprights $\frac{3}{4}$ of an inch from their front edges; this will throw the ornamental board, when placed against them, $\frac{1}{4}$ of an inch back from the general level of this part of the book-case front, which is desirable for the purpose of imparting a good effect to the whole.

The woodwork finished it remained to nail a strip of some material along the front edges of the shelves to keep out dust. In my case I found that the ornamental leather sold for the purpose was too costly, and had to resort to a substitute of a more humble kind—namely, American leather-cloth. I chose one of a dark-green shade, and cut strips 4 inches wide. It is desirable in a book-shelf edging to have it cut into scollops, since this will allow of the removal or restoration of a book without crumpling or displacing the edging on both sides; the scollop alone gives way, and falls back into place again of itself. Fig. 22 shows the scollop which I used. I first cut it out in card, and then laying the card on the leather-cloth, traced the outline with a steel point. The round holes at the tops of the slits I punched with a small gouge. In the diagram the upper $\frac{3}{4}$ inch is supposed to be folded under so that the studs which fix it to the shelf pass through two thicknesses of stuff. Fastened on with bright brass studs my green edging looks very well, and gives a handsome finish to the whole affair. I should observe that the edging over the upper shelf of the upper part is tacked to the lower member of the cornice; whilst that over the upper shelf of the lower part is fixed to a narrow strip of wood, bradded on beneath the overhanging top-board.

It now only remains for me to remark, in conclusion, that of the diagrams which illustrate this book-case, Figs. 8, 9, 10, 11, 12, and 13, are 1 inch to the foot; Figs. 14, 15, 17, and 21, are 2 inches to the foot; Fig. 22 is 3 inches; whilst Figs. 16, 18, and 20, are 6 inches, or half the actual size.

(*To be continued.*)

HOW TO PHOTOGRAPH A GROUP.

By JOSEPH HARRIS.

WITH the coming of the spring the photographer overlooks his apparatus, defective portions are repaired, suggestions resulting from past experience are taken into consideration, and families and friends are exposed in the most ruthless fashion before its dreadful lens.

What a wretched caricature is the average photographic group! Cricketers and volunteers, board school children and policemen, the clerical element and the damsels engaged in the last new burlesque, all the heads arranged in straight lines, one above another, and each individual face absorbed in the intellectual process of staring in the most painful manner at nothing at all, and trying to look "interesting" under the depressing circumstances of the situation.

If, for the sake of vanity, one of these human items were requested to stand out of the regulation attitude, the possibility is that the reply would be a polite negative, a front view would be insisted, in order that the Waterbury watch pocket might be included in the picture. But is there any pictorial composition by any artist of note where all the figures of a group combine an unabashed stare on the unfortunate spectator?

A group of several figures requires breaking into masses or component parts. There must exist a central point of interest, or subject, which must be carried through the subordinate features of that group. Each person must aid in elucidating the theme. There is no vital necessity for the portly father of a family to fill up the centre of the picture, while the progeny huddle around the author of their being as chickens around a hen, but with this difference—the chickens will disport to avoid monotony.

The front elevation of a brick wall is not remarkable for excellence, so far as regards artistic composition. The front elevation of a wall of human heads is open to similar condemnation. It is neither original nor harmonious in treatment. Leech drew a capital bit of life in one of his militia sketches—"Jim, you baint in step." "Baint I; well, change yourn!" Now, why is the photographer to keep out of step with his brethren of the brush in order to favour his lens at the expense of his subject? *Authority* says: "Always favour the natural curvature of field as produced by the lens, *i.e.*, if possible, let the side objects be nearest to, and the centre ones farthest away from, the camera." But why continue the "curvature" business to make the best of optical shortcomings? If the lens "baint in step" with artistic requirements, change it, or change the treatment of it. Try an objective which will satisfy the not very extravagant desire to escape that photographic rut—lines of faces arranged "curvature-of-field" fashion.

With a Steinheil group anti-planetic, study the picture, and leave the rest to the instrument. Never arrange a group against a mass of foliage, the light on the leaves gives some people the appearance of an unusual proportion of nose, while others appear to have floral excrescences protruding from various portions of the body, and to such an extent that without due deliberation it is extremely difficult to decide which is human anatomy and which appertains to botany. It has not been accorded to all of us the beneficent advantage of passing that board school standard, in which has been attained a rudimentary acquaintance with tracheotomy, phlebotomy, and all the other "otomies." Therefore, keep away from the shrubs and the brick walls, and go for a porch, a verandah, or any thing which will not give monstrosities growing out of people's bodies. Do not pose the full-grown male or female animal on its haunches; unlike the Easterns, they are not accustomed, and as a consequence, figure excessively awkward and ungainly.

The best groups are those in which children play an important part; they are not so easily suppressed or awed as their progenitors, and their vivacity gives a vitality and a contrast to the subdued mien of their elders. To take a happy group of a half-dozen or so grown people, with possibly the minister under whom they "sit" once a week, year in year out, is a task fit to make the most experienced photographer quiver with emotion. There must be no levity, that would be frivolity, but austerity unleavened by just a suspicion of the vanity of this wicked world, will convey in the photograph too vivid an impression of the man of sin contemplating the wrath to come. Two or three wild young colts of children will make human beings of these people, and it is the natural, not the artificial side of humanity which makes the popular photograph.

In a large proportion of groups will be found the photographic terror, the young lady who considers herself a beauty. Being a lady, she must be treated with deference, but just as everything is ready she has the peculiarity of imagining that her position is not good, that her back hair is falling down, that a particular frilling is not doing its full share of duty, or that some one is making her laugh. Laughter is happily contagious, but laughter when the lens has been uncapped is levity ill timed. The consciously beautiful young lady cannot be isolated, but it may be delicately suggested she might prefer a sitting after the group has been taken. This proposition will in-

evitably result in a vivid illustration of the sublimity of resignation to a stronger will. Some photographers have a rooted antipathy to the funny man. Surely some allowance ought to be made for him. He must do something to sustain his own popularity and the hilarity of the company, and he can be easily toned down at the critical moment. Snub him, and his expression will spoil the photograph ; humour him, and he is master of the ceremony. This gentleman must be made much of. One of the German dukelets was once ushered into the presence of Baron Rothschild ; the great financier requested his visitor to take a chair, at the same time continuing his correspondence. "Do you know who I am ? I am the Duke of ——." "Take two chairs," was the response, and the writing continued.

In preparing to take a group, arrange the instrument to include so much subject background, and note the portion covered by the lens ; this limits the field the group is to occupy. Place an object, as a garden chair, a third across this limited field, and focus it, that operation is now done with, and there is nothing left but to introduce the figures and get over the business quickly. Do not shift the positions of the sitters, making needless alterations which should have all been thought out and studied beforehand. Have a preconceived idea, and carry it out ; let the children alone, and avoid too many pyramids. Pyramids are rather dangerous subjects to those who have never received a lesson in art. An equilateral triangle is a capital illustration of the pyramid, but it would be highly objectionable to have one head at the apex, and one at either angle of the base, so that *straight lines can be drawn from point to point in the composition. If parallel lines can be formed out of legs, arms, or heads, if formal triangles can be made by imaginary lines from face to face, if heads are in vertical or horizontal line, it is to very little purpose discussing balance and pyramids till these primary errors in composition be realized and corrected.*

It has been written that in the photographic group no figure must be sacrificed for the sake of pictorial effect ; every face must present a favourable portrait independently of the others. Strong exception must be taken to this statement. It is no sacrifice of a human figure if that figure to help a composition will condescend to exhibit a three-quarter back view of its noble proportion, turning the head in profile. What is required is *not* the group usually demanded from the photographer, but the photographer capable of composing a group. The photographer *may* be nearly always heavily handicapped by having to give an equally good portrait of each individual in the group, but he is far more heavily handicapped through not knowing what to do with his group now they are standing before him waiting his inspiration ; and nine times out of ten the result will be—the shorter one will please stand while the other two sit down, with perhaps a fourth to sprawl down, playing Bottom at the feet of Beauty.

There is a military depôt in England—there are military depôts in England even though the swords are shams. The local photographer at this military depôt is quite a shining light in professional ranks, and this is how he disposes a military group. Some six or eight chairs are brought into the back garden, and as quickly occupied by the *tall* members of the party, the short ones stand behind, and any extra items will crowd, crouch, or squat, between the legs of the sitting figures. If this be presenting a favourable portrait of each man, the question will arise where to draw the line when the unfavourable ceases.

We have some few centres of education in England. One would imagine in these homes of culture where the Latin is not yet regarded as a dead (!) language that the ever-present photographer would rise to his surroundings.

Cricketing groups and boating groups are matters of almost daily requirement. The arrangement—it is cause for regret even this word cannot be written in the plural if regard be had to *approximate* truth, the stereotyped arrangement is, the one row standing, one row sitting, and the haunch and cross-legged business in front. If this be not sacrifice of the human form, what is ? Another writer on the subject of groups advises the amateur to follow closely the counsel given by Punch to young men about to marry, "Don't." Considering that there exist very many amateur groups far superior in composition and effect, and quite equal in manipulation to the finest which have emanated from professional studios, this suggestion is, to say the least, questionable.

If the amateur can but shame the professional out of the one row standing, one row sitting, and the haunch, he will indeed accomplish much, and he may take this consolation unto himself, that group as he may he cannot do worse than his brother has done. The ordinary photographer with a group is like a gipsy with an iron wire. "What are you making there, friend ?" "I don't know—if it comes straight a nail, if bent a hook !" Never take a group in the sunlight, never take a group under the heavy shadows from trees. If there be no shade at hand, except that afforded by trees, arrange the group at the edge of the shadow and expose fully. Never take a group where a quantity of detail exists in the background, it confuses the faces of the sitters. Never take a group with some of the faces in bright light while others are in deep shadow. Never take a group with the faces against the sky. In taking a group

aim at truth and sincerity, discard all conventionality, seek for graceful outlines, and leave the pyramids for an Egyptian tour. Make especial study of Canova's "Three Graces," and then by contrast examine some photographic triads. When a group has been arranged, never rush about at the last moment for a patch of white to stand out against the deepest shadow, or to find a bit to make up a foreground, all this should have been studied beforehand. In out-door groups, if there be a choice, have the heads covered, the modelling of the face is thereby improved and the light on the top of the head avoided.

ELIZABETHAN FURNITURE.
WITH PRACTICAL HINTS FOR ITS CONSTRUCTION.

By Rev. ALGERNON THOROLD, M.A.

II.—Growth of Furniture—Chest, Settle, and Cupboard—Tudor Cradle—Gothic Cabinet by Pugin—Furniture of the Renaissance Period—Elizabethan Furniture—Gibbons' Carvings—Ruskin on the Great Arts.

AFTER the Norman period no alteration was visible in household furniture till about the middle of the thirteenth century, when, however, the art of construction in wood seems to have obtained more attention. It was about this time that panelling and framing were introduced, a method of workmanship which is most generally found in the chests of that time. Henry the Third is said to have been the first to use panelled rooms.

The natural inconvenience of turning one or two pieces of furniture to many and entirely distinct purposes undoubtedly give renewed strength, if not actual birth, to the art of carpentry, an industry which, when once it had obtained a name and impetus afterwards, expanded into the productions of the cabinet-makers and joiners of the fifteenth and sixteenth centuries. That necessity is the mother of invention was never truer than in those early times is seen in the growth of one piece of furniture out of another.

Chests, it is known, were originally but useful receptacles for clothes and other small moveables. But very soon, as chairs were not then in fashion, the lids of these chests were found convenient both for seats and tables. But, by degrees, it evidently occurred to their possessors that arms would be a comfortable addition to the tops of these chests—an innovation which clearly soon led to the introduction of large arm-chairs, or settles, as they were called.

After another interval these chests seem to have suggested a still further addition to the household requirements, and accordingly they were made with longer legs and a further arrangement of cupboards above, and so grew into "dressoirs," or cupboards, and finally into side-boards, buffets, and elaborate cabinets.

There can be little doubt, however, that although certain and constant additions were made to the household furniture of these times to meet needs which had become pressing, the greatest strides were brought about through the action of the numerous monastic bodies then existing. These communities numbered amongst their inmates men who were skilled to a high degree in the arts of Italy, France, and Germany, and, in consequence, were not only centres of all the learning of the times but the actual manufacturers of various objects of utility and beauty which were in daily request. At this time the houses of the foreign monastic orders were famed for the magnificence of their furniture, and owing to the frequent communication between England and the Continent, the "Orders" of this country were not far behind.

The example set in this way soon found imitators outside the walls of these establishments, and from the castles of royalty to the houses of the nobles, and thence throughout the country, the desire spread to adopt the beautiful woodwork of ecclesiastical pattern for domestic purposes. The modifications which of course were necessary, possibly both in design and decoration, gave rise to an independent order of workmen in wood, and from these descended the clever designers of both ecclesiastical and domestic Gothic woodwork, which did such splendid work in the fifteenth century and were known as "joiners." There is comparatively very little true English domestic furniture in the Gothic now existing. Fig. 2 shows, however, one of these very rare specimens—a Tudor cradle. It is perhaps of rather later date than of what we have been speaking, but as an example of the style it is most interesting. It stands in an old Sussex country house, a great part of which also is richly panelled with carved work in the linen fold pattern. Fig. 3 shows a fine Gothic pattern after a design by Pugin. The great impetus in the production of domestic furniture did not, however, fairly set in until the rival houses of York and Lancaster had adjusted their quarrels, and the disastrous Wars of the Roses had come to an end. But when a quiet government had restored confidence art made quicker strides, and what has been handed down to us from those days gives full proof of the spirit which was spreading in England and filling its homes with rich and beautiful works.

At the close of the fifteenth century the style and designs of domestic furniture in England began to feel the effects of the Renaissance, or return to classical models, which for some years had been making progress in Italy, for even the best work of mediæval

times had now lost its attractions, and the arts were languishing somewhat for the want of new spirit.

The great Renaissance movement came at last, following in the wake of the earlier steps which had first raised the enthusiasm of the classic land where art and beauty had flourished long before. Rich discoveries in Italy of statuary, bronzes, and gems, gave an impulse which soon found ardent followers and ready patrons. The change which now, more or less, passed over every country in Europe, was almost as much marked in domestic furniture as in architecture.

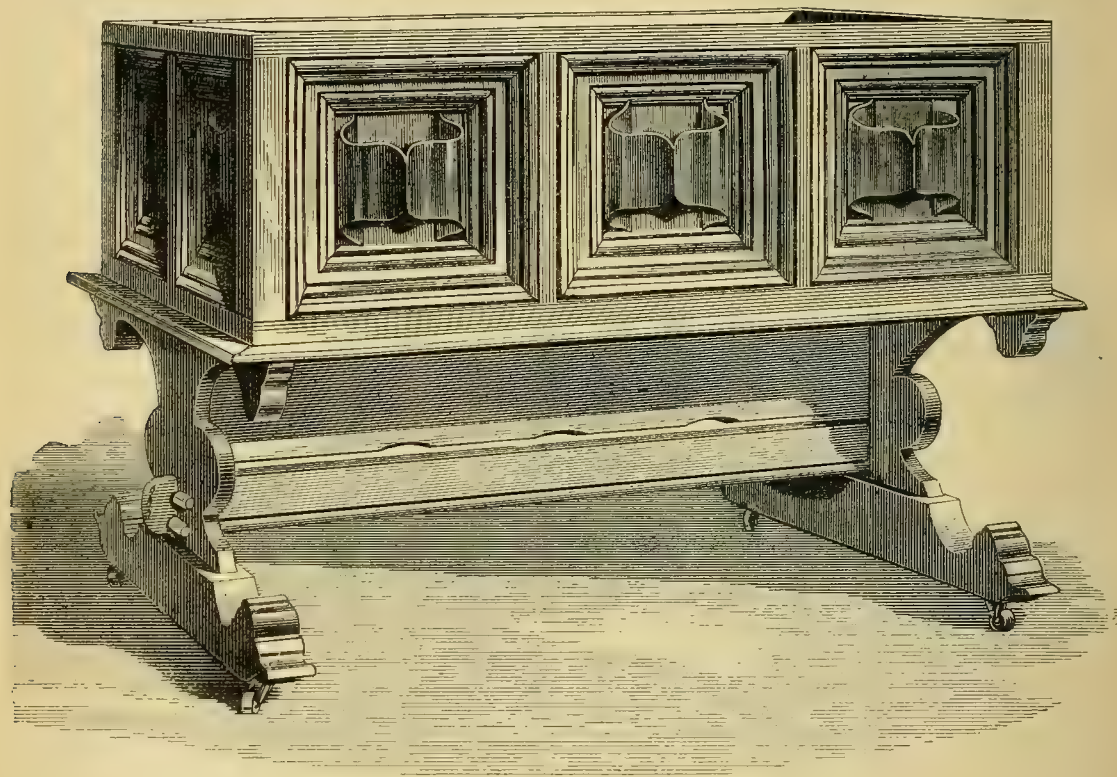


FIG. 2.—TUDOR CRADLE.

Richness of design, costliness and variety of material, beauty of workmanship, were lavished with a ready hand, and where before the masters in carved work had rested satisfied with the skilful use of their chisels, the workmen of the Renaissance had resort to gilding and the unsparing use of inlays in valuable stones, marbles, and even tortoiseshell.

Towards the middle of the sixteenth century, classical learning and foreign magnificence were greatly favoured by Henry VIII., and under his distinct patronage some of the most skilful artists of the times came over to England. Masters of the Italian, German, and Swiss schools designed and executed splendid work, and some of it which bears marks of their combined styles is known as Italian and Holbeinesque design.

The next important change which passed over this country is only divided by a few years from the commencement of the Renaissance period, and is known as Elizabethan, and in describing it we cannot do better than adopt Pollen's description :—

"The character," he says, "of the woodwork throughout this period consists in actual architectural façades, or portions of façades, showing arrangements wherever they are possible of the five orders of architecture or of pedimental fronts. Door-ways and chimney-fronts are the principal opportunities in interiors for the exercise of this composing skill. Panelling remained in use in the great halls and most of the chambers of the house, but the linen pattern so graceful and effective went out of fashion. The angles of the rooms, the cornices, and spaces above the doors were filled with groups of architectural cornice mouldings, consisting of dentil, egg and tongue, and running moulds, and sometimes room walls were divided into panels by regular columns. Heraldry, with rich carved mantlings and quaint form of scutcheons (the edges notched and rolled about as if made of the notched edges of a scroll of parchment),

was a frequent ornament; grotesque, terminal figures, human headed, supported the front of the dresser, the chief furniture of the dining-room, and of the cabinet. Table supports and newels of stair rails grew into heavy acorn-shaped balusters. In the case of stair balusters, these were often ornamented with well-cut sculpture of fanciful and heraldic figures. Inlaid work also began to be used in room panelling as well as furniture; bed heads and testers, chest fronts, cabinets, etc., were inlaid, but scarcely with delicacy, during the early Elizabethan period. The art was developed during the reign of James, when, in point of fact, the larger number of the Tudor houses were erected. When the Tudor period was succeeded by that of the Stuarts, the same general characteristics remained, but all the forms of carving grew heavier and the execution coarser. The table legs, baluster newels, and cabinet supports had enormous acorn-shaped masses in the middle; the objects themselves, such as the great hall tables, instead of being moveable on trestles, became of unwieldy size and weight."

The cumbrous design and swollen proportions of much of the furniture of this period is distinctly to be traced again to foreign influence, and it is most difficult sometimes to determine whether a specimen is of English or Dutch manufacture. The Flemings had for some years sent over their manufactures to this country, and there is no doubt that the late Jacobean style was largely borrowed from these designs. The early work of the Dutch workmen of this period was distinctly lighter and of better type than what followed, and therefore, from a connection between the two, the same may be said of English contemporary design and execution. In both, the tracery, carving, figures, grew coarse and indifferent, and needless ornaments in the form of diamond-shaped blocks and split columns were fastened upon flat surfaces, which formerly would have been carved in relief. All this naturally gave a heavy, and uncouth, and unnatural appearance, and marked the decadence of the art. There is but one more style of English carved wood-work of which we need speak, that is, of Grinling Gibbons.

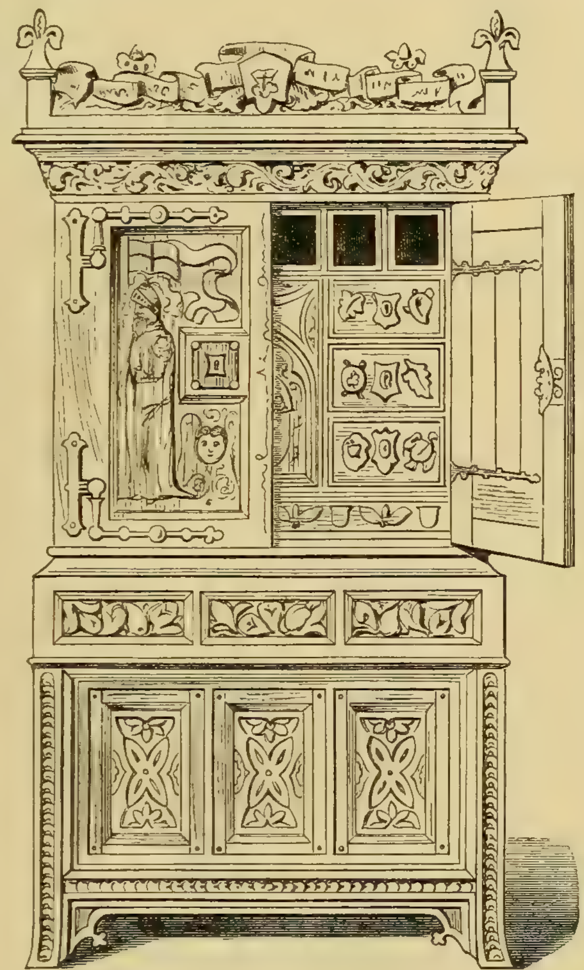


FIG. 3.—GOTHIC CABINET BY PUGIN.

This great artist in carved woodwork was in his best days about 1700, and the specimens left to us give proof of marvellous accuracy of design and skill in manipulation. He is said to have been of Dutch descent. His special work was in flowers, fruit, birds, drapery and figures, and his materials were the softer woods, but principally lime.

In examining his masterpieces it seems almost incredible that the extraordinary grouping of flowers, fruit, and birds, should have actually been worked from the solid, their relative position and form seeming to necessitate the combination of fastenings other than afforded by the fragile stems and tendrils which curl round them with such lightness and beauty. Magnificent specimens of his work are still standing in the church of St. James, Westminster, the choir of St. Paul's Cathedral, Chatworth, Petworth House, and the free library at Bristol. He had many enthusiastic scholars, whose work, learnt from the great master himself, may be found in many parts of the country. Grinling Gibbons died in 1721.

It is not necessary for the purposes of this paper to continue further our enquiry on old English furniture. With Grinling Gibbons and his school the heavy carved decorations of household furniture and interiors came practically to an end, and the lighter style of carving brought in by Chippendale and the

gracefully designed and exquisitely executed work of Adams, Sheraton, and Heppelwhite, came into fashion, and took the place of the heavy Elizabethan and Stuart pieces.

The whole subject of domestic woodwork is one that would well bear a far more exhaustive enquiry and description than can be devoted to it at the present time, and perhaps there are few amateur joiners and cabinetmakers who would not wish, if it were possible, to trace out much more in detail the early steps of the art in which they are so much interested. But for the present, this brief sketch is all that can be offered, showing how civilization in the course of eight hundred years carried our ancestors on step by step, till the earliest and rudest form of furniture and carpentry has grown from the simplicity of a rough box, representing all their ideas of convenience and art, into the several stages of Norman, Mediæval, Tudor, and Elizabethan styles, and thence, once more, to the unparalleled luxuriousness of our nineteenth century surroundings.

Before, however, we enter upon the technical part of this paper, and take our tools in hand for the purpose of imitating, if possible, a few of the sixteenth century designs, collected for this purpose from authentic specimens, it will be well to read what Ruskin says in his lectures about the art in which both the writer and readers of these pages are mutually interested. Perhaps some will remember Ruskin's words, which may well be reproduced here.

"All the great arts," he writes, "have for their object either the support or the exaltation of human life—usually both; and their dignity, and ultimately their very existence, depends on apprehending with right reason the nature of the materials they work with, of the things they relate or represent, and of the facilities to which they are addressed. And farther, they form one united system from which it is impossible to remove any part without harm to the rest. They are founded first in mastery, by strength of arm, of the earth and sea, in agriculture, and seamanship; then their inventive power begins with the clay in the hand of the potter, whose art is the humblest but truest type of the forming of the human body and spirit, and in the carpenter's work, which probably was the early employment of the Founder of our religion. And until men have perfectly learned the laws of art in clay and wood, they can consummately know no others. Nor is it without the strange significance which you will find in what at first seems chance, in all noble histories as soon as you can read them rightly—that the statue of Athena Polias was of olive wood, and that the Greek temple and Gothic spire are both merely the permanent representations of useful wooden structures. On these two fine arts follow building in stone, sculpture, metal work, and painting, every art being properly called 'fine' which demands the exercise of the full faculties of heart and intellect." He then goes on to say that the fine arts are not necessarily imitative or representative, for their essence is being occupied in the actual production of beautiful form.

Among the inanimate, as chosen from designs in the solid, excepting, of course, the delineation of the human form, the beauty of work in wood is second to none. And so, on the great truth laid down by Ruskin, wood workers who find their early love for greater things kindled by the dexterity they attain at the carpenter's bench may truly think their time well spent when they learn that, perhaps unconsciously, they have been all the while moulding their minds by the use of the rule, the chisel, and dividing tool, elevating their innate powers of thought to the true appreciation of the higher and finer arts, and even to the better carrying out of their part in life towards which such appreciation must unfailingly assist.

(*To be continued.*)

THE MAGIC LANTERN:

HOW TO MAKE IT AND USE IT.

By A PRACTISED HAND.

VI.—The Standard Slide—Hand-Painted Slides—Mounting the Slides—Silhouette Slides—The Slipping Slide—The Double Slipping Slide—The Lever Slide—The Double Lever Slide—Conundrum Slides—Simple Astronomical Slides—Statuary Slides—The Slide-Tinter—Panoramic Effects—Rackwork Slides—The Chromatrope.

WE must now turn our attention to the slides, after which we will see how some of the best effects are produced.

The Standard Slide is, as I said before, 3¼ inches square, which, on the whole, seems to be a very practical size. Many slide producers have, unfortunately, adopted other sizes, so that at the present time there are slides of three or four different sizes in the market. Thus the slides which are taken on what the photographer calls ¼-plate glasses, are 4¼ inches by 3¼ inches, and the French slides are about 3⅞ inches by 3¼ inches, while the stereoscopic transparency when cut in half to form a slide is about 3⅜ inches by 3¼ inches. These last, when not too dense, make very good slides. Those transparencies which look thin, or, in other words, seem to lack density in the stereoscope, make, as a rule, the best lantern transparencies. As it is only the length of the slides that varies (the width being

always the same) the carrier I have already described can be used with any and all of them. The only difficulty is in centring them; that is to say, pushing them into exactly the right position in the frame. With the $3\frac{1}{4}$ inch square slides, the first is always brought into the exact position by pushing the second slide after it in the holder, until its outer edge is on a line with the end of the carrier; but it is evident that it would not do to push a longer slide in in the same way, as the first slide would then be pushed too far. What we want then is something to show us exactly how far to push them in when they are not of the standard size. The simplest plan is to screw a strip of wood to the top of the carrier, so as to project $1\frac{1}{2}$ inch beyond the end. This will do for the long slides, which are to be pushed in as far as the end of the wood. If you intend to show French slides, you must cut a notch in the wood $\frac{9}{16}$ inch from the end of the wooden strip, and push them in as far as the notch. For the half stereoscopes, you must cut a second notch in the wood, or gum a little wedge on to it $\frac{3}{16}$ inch from the end of the carrier. You will thus be able to exhibit slides of different sizes without changing or shifting your carrier. All you have to do, is to remember that the standard slides are to be pushed in flush with the end of the carrier, the half stereos, as far as the first (or inner) notch, the French slides to the second (or outer) notch, and the long slides as far as the end of the wood only.

Hand-Painted Slides are much more difficult to prepare than many people suppose. The painting of slides is, in fact, quite an art in itself, and a good deal of practice is required to become proficient in it. When it is considered that a highly-finished picture has to be painted on a glass little more than 3 inches square, and that all the details have to be put in so delicately and neatly that the picture will bear magnifying to ten or twelve feet, the difficulty of the task becomes at once apparent. Outlines on glass can be used by those who wish to paint a series of slides but do not care to draw the pictures. As full directions for colouring slides have already been given in AMATEUR WORK, I need say no more on the subject.

It would be beyond the scope of these papers to enter into particulars on the taking of photographic transparencies. The *modus operandi* is set forth in most of the text books on Photography. In choosing slides for the magic lantern, the exhibitor should remember that dull heavy views look dull and gloomy on the screen, and, in fact, can only be shown with the lime-light. Many transparencies which would look well if left plain are quite spoilt by being over-coloured. To my thinking, a really good photograph is never improved by colouring, and though, of course, coloured pictures are by many preferred to plain ones, there is no reason why our best transparencies should not be shown as they are. Variety is always pleasing, and a plain photograph comes in very effectively after a number of coloured ones. With plain photographic transparencies, too, the slide-tinter can be used, and thus the pleasing effect of different tints can be shown. The plan so frequently adopted of colouring every slide in the same way and with the same depth of colour; in other words, colouring them by the dozen without any regard to artistic effect, is most strongly to be condemned. They would look far better not coloured at all than coloured in this way.

Before passing on to describe the different "effects," I must say a few words on

Mounting the Slides.—Every slide, whether hand-painted or photographic, should be mounted with a plain glass over the face to protect it. A paper mount, square, oval, cushion-shaped, or round, A, B, C, D, Fig. 50, is interposed between the slide and the glass, and forms a sort of frame for the picture. The edges of the glasses are then bound over with strips of gummed paper about $\frac{1}{2}$ inch wide. Any paper will do; but that generally used is black or purplish brown. The mounts ought to be black on one side and white on the other, so that if they are always put the same way between the glasses, you can tell at a glance which is the right or film side of the picture. If plain black mounts are used (and they are generally stamped out of sheets of black paper) you will find it a good plan to mark them on one side with white paint, or else to write the name of the picture on a strip of white paper and gum it on to one side of the mount. Before finishing off the slide, you should make sure that both it and the plain glass are clean and dry; you must also be careful that no dust or grit gets in between them. The plain glasses should, as a matter of course, be entirely free from bubbles and scratches.

The slides are sometimes put in separate wooden frames. There is less chance of their being broken when thus mounted; but it makes them so much bulkier and heavier that the plan is not now often adopted. Fig. 51 shows one of the frames; it is made in four pieces of well-seasoned mahogany. Each piece is grooved so that when put together the slide is held all round by the grooves. The end-piece, A, is left loose until the slide is put in, when it is fixed in its place with gum or a couple of small screws.

The different effect slides must now engage our attention.

I will first describe those which are easily arranged and which can be shown with our lantern, and then

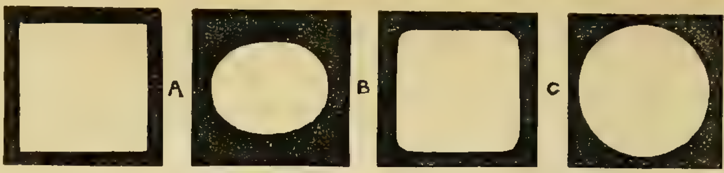


FIG. 50.—DIAGRAM ILLUSTRATING MODE OF MOUNTING SLIDES.

some of the more elaborate effects for which two or three lanterns and a series of slides will be required; and, lastly, I will explain how certain experiments can be shown in the lantern.

Silhouette Slides are very amusing, and can easily be made by any one who is clever at cutting out figures in paper. Portraits of friends or public characters are sometimes selected; but grotesque figures are the best. They should be cut out of black paper, and must not be more than about $2\frac{3}{4}$ inches in length. They are gummed on to strips of glass $3\frac{1}{4}$ inches wide, and nine or ten inches long. Another way of preparing them is to cut the figures out of coloured tissue paper, and then to paint in the folds of the drapery, etc., or they can be cut out of white tissue paper, and coloured with transparent colours. The effect is pleasing, but the plain black figures are the most comical, and are, therefore, preferred. They are best shown at the conclusion of an entertainment as a sort of "wind up." All kinds of suitable comic figures stamped out of sheets of paper can be purchased by those who do not care to take the trouble to cut them out for themselves.

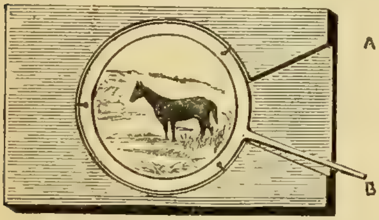


FIG. 54.—LEVER SLIDE—LEVER DOWN.

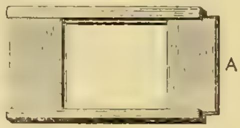


FIG. 51.—WOODEN FRAME FOR SLIDE.

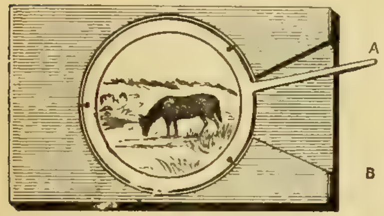


FIG. 55.—LEVER SLIDE—LEVER UP.

Skeleton leaves, sprays of maiden-hair fern, pressed flowers, and similar objects, when mounted between two glasses make interesting slides, and may be shown during an interlude, or if it is desired to lengthen an entertainment.

FIG. 52.—SLIPPING SLIDE—CLOSED.

FIG. 53.—SLIPPING SLIDE—DRAWN OUT.

A great many pleasing effects may be produced by means of *The Slipping Slide*, shown in Figs. 52 and 53.

As will be seen there are two glasses mounted in an oblong wooden frame about 7 inches long by $4\frac{1}{4}$ inches wide. One glass is fixed in the frame; the other slides in grooves immediately in front of and as close as possible to the fixed glass. There is an aperture either square or round in the centre of the frame through which the picture is shown, and which should be about 3 inches across. The figure (in this case a head with a protruding tongue) is painted on the fixed glass, and on the sliding glass a space immediately over the tongue and sufficiently wide to cover it when the glass is pushed in, is stopped out either with black paint or by gumming a little bit of black paper on to the glass. The slide is shown with the slipping glass (as the latter is called) in, as in Fig. 52. The tongue is not then seen, but will appear to protrude further and further as the glass is drawn out (Fig. 53). The object of cutting the slipping glass off at an angle is to enable you to regulate the sliding movement by fixing a plug in the lower groove to act as a stop when the glass is pulled out far enough. The fixed glass is generally an ordinary square $3\frac{1}{4}$ inch slide glass. The

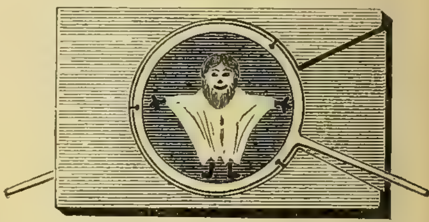


FIG. 56.—DOUBLE LEVER SLIDE—DOWN.

FIG. 57.—DOUBLE LEVER SLIDE—UP.

length of the slipping glass must depend upon the distance it is to be drawn out to produce the desired effect. All the plain glass round the figure is generally stopped out on the fixed glass. A great many effects can be shown by means of the slipping glass arrangement: for instance, the man's nose can be made to elongate, he can be made to grow a beard, etc. A very comical effect could be arranged by painting a long-nosed figure with his thumb to his nose on the fixed glass, and stopping out a space on the other in such a way that when the latter is pulled out the hand is put to the nose, in imitation of the imaginary "coffee mill."

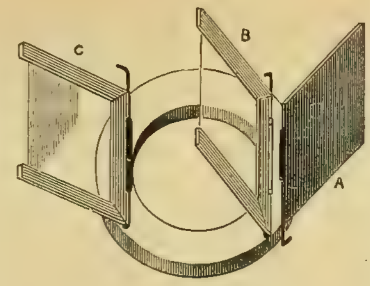


FIG. 58.—SLIDE TINTER.

The Double Slipping Slide is arranged in the same way, only there are two slipping glasses instead of one: they should run in grooves on either side of the fixed glass. With this slide we can get a double movement, which, of course, makes the effect more interesting.

FIG. 60.—RACKWORK SLIDE.

Three, and even four slipping glasses might be used, but they would be rather complicated to arrange as well as awkward to use; and, besides, unless the glasses themselves were very thin, the slide-frame would have to be inconveniently thick; and, further, there would be a difficulty in the focussing. Of course, with the double slipping slide one glass could pull out on one side of the frame and one on the other, or both could be made to pull out on the one side, in which case the end of one glass should be at top and that of the other at the bottom of the frame.

The Lever Slide consists of two glass discs each about $3\frac{1}{4}$ inches in diameter, one is fixed into a wooden frame with a 3 inch circular opening in the centre, the other is fixed to a flat brass ring of corresponding size, with a lever on one side, by which when put into the frame over the fixed glass it can be partly turned round. In Fig. 54 a horse is represented standing beside a pond, and in Fig. 55 his head is down, and he appears to be drinking. The body of the horse, the pond, and the various parts of the picture are painted on the fixed glass, and the horse's head and neck on the movable glass; then by merely raising or depressing the lever the horse is made to put his head up or down in a fairly natural way. It should be noticed that the horse's neck is in the exact centre of the two discs, and that the head is on a straight line with the lever. In this class of slide the part where the movement is to begin must always be in the exact centre. The moving glass is kept in its place by means of three little pins driven into the side of the opening or cell. Part of the frame is cut away to give play to the lever as shown. The distance between A and B regulates the movement of the lever. Subjects suitable for this class of slide are children swinging on a log, a man chopping wood, bowing figures, etc., etc.

FIG. 59.—SLIDE EXHIBITING PANORAMIC EFFECT.

Double Lever Slides have one fixed and two movable discs, the two latter being mounted on separate brass rings, and let into the frame on each side of the former.

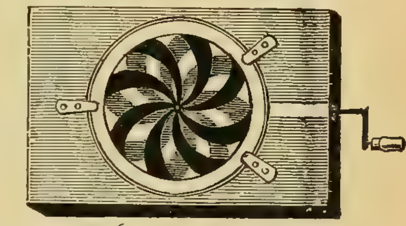


FIG. 61.—CHROMATROPE SLIDE.

Instead of brass rings, tin or stout cardboard rings might be used, a strip being left at one side of the ring to form a lever. The ring should be $3\frac{1}{4}$ inches in external and about 3 inches in internal diameter, and the lever may be 3 or 4 inches long. The glass discs can be gummed on to the ring. A specimen of the double lever slide is shown in Figs. 56 and 57 where we have a ghost waving its arms. An effect of this kind is generally "flashed" on to the screen either by itself or over some suitable picture, such as a churchyard by moonlight: it is then very effective. The arms should be down, as in the first figure, when thrown on to the screen; the arms are then raised and lowered, either together or alternately according to fancy, by working the levers simultaneously or one after the other. When shown with another picture, a second lantern is, of course, required. I should

mention that the face of the ghost and the central part of the drapery are painted on the fixed glass, the upper part of which (that surrounding the head) is stopped out, and the left arm and left side of the drapery are painted on one movable disc, the right arm and right side of the drapery on the other, the lower part of the discs and the part surrounding the arms are then stopped out, so that the ghost is shown white on a dark background.

Conundrum Slides are great favourites with some. They are generally shown by means of the slipping slide arrangement. A piece of blackened cardboard with an aperture 3 inches in diameter in the centre may be substituted for the fixed glass. The conundrum is written within a 3 inch circle near the outer end of the slipping glass, and the answer in a similar circle just beside it. The slide is shown with the sliding glass pushed in, which brings the question opposite to the aperture: then when the glass is pulled out the answer is brought into the aperture.

Simple Astronomical Slides.—The comparative size of the planets, their orbits, the phases of the moon, eclipses of the sun and moon, the constellations, etc., etc., can easily be shown on the screen by cutting suitable diagrams out of black paper, and gumming them to glasses to form slides. Mr. Woodbury describes a very simple way of preparing a number of diagram slides. He used blackened cardboard and punched holes in it of different sizes to represent the planets, covering the holes thus made with bits of coloured gelatine (the coloured gelatine that is used to decorate crackers will do), selecting the colours assigned to the different planets in the text-books on astronomy. The orbits can be indicated by making the minutest holes with a very fine needle along the line previously marked out. Jupiter's bands, if the planet is shown on a sufficiently large scale, could be traced in with water colours on white silver paper, or by gumming bands of silver paper of the proper colour over the hole. A diagram to show the phases of the moon would be cut out with a fine sharp penknife. The constellations are marked out with needles of different sizes, using for the first magnitude stars the coarsest needles, and the finest needles for those of the third or fourth magnitude. The colours of the stars can be shown by covering the needle holes with the gelatine films, otherwise they should be left plain, and in either case, care must be taken not to shut up the holes by rubbing the cards.

Statuary Slides.—Photographic reproductions of statues look very well on the screen; but, unfortunately, are not always shown to the greatest advantage. They are generally stopped out so as to show white on a black background, but unless a slight blue tint is thrown over them from another lantern, or by means of the slide-tinter (Fig. 58), they will have a rather chalky appearance.

The Slide-Tinter consists of a metal ring (either brass or tin) to fit on to the nozzle of the objective with three arms, A, B, C, hinged to it; one, A, forms a shutter, and is made of a piece of japanned tin 4 inches square; the others, B, C, are metal frames with grooves to hold sheets of coloured gelatine. The figure shows the arrangement so that no more detailed description of it is needed. It is a handy little instrument, but we can produce the effect very well without it by merely holding the gelatine films in front of the objective. The films must always be kept in a book so as to have them quite flat and uncreased, and the book must be put away in a dry place. Three colours will be quite enough for ordinary purposes some exhibitors only use two: the most pleasing effect is produced with a violet film; red, if not too deep, is also pretty; blue produces a moonlight effect. It is the best colour to use with statuary slides. A good way of showing these slides, as well as plain photographic transparencies in a single lantern, is to make a frame of either strips of wood or stout cardboard ten or twelve inches long and about 4 inches wide; at one end you must put a bit of blackened cardboard large enough to shut off the light when held in front of the objective. It is cut into teeth so as to form a sort of dissolver. Over the teeth you put two or three sheets of gelatine (blue or violet), then, further on in the frame, one sheet, and then a sheet of a paler tint. When this simple contrivance is moved in front of the objective, a pale blue (or violet) tint is seen on the screen: this tint deepens and deepens until the teeth begin to intercept the light when the picture fades out of sight. The slide must then be quickly changed, and the frame moved back so as to bring on the next picture. A rackwork arrangement for moving the frame could easily be fitted to the table or lantern stand, but if the tinter is only used now and then, it will scarcely be necessary.

Any long view, such as a range of mountains, a wide bay, etc., can be shown as a

Panoramic Effect.—The view is painted on a strip of glass $3\frac{1}{4}$ inches wide and 10 or 12 inches long. The picture is put into one end of the carrier and moved slowly forward. A very much better effect is produced by fixing an ordinary photographic or painted slide into a frame, as in Fig. 59, and on a strip of glass, B, which slides in grooves in the frame immediately in front of the picture, A, painting a number of figures, animals, ships, boats, or other objects suitable to the view. A space on the glass strip equal to the length of the slide is left plain at one end, and the picture is first shown without the figures, which

can be brought on at any moment by pushing in the glass. If a seascape is to be shown, the effect of rolling waves can be fairly well exhibited by painting a rough sea on two strips of glass about 3 inches wide, then by moving the glasses in opposite directions with an undulatory movement, which, as they will move very freely in the grooves, can easily be managed, the sea will appear to be rolling across the view.

Rackwork Slides consist of a circular fixed glass with a movable glass in front of it, which latter is made to rotate by means of a rack and pinion arrangement. Fig. 60 shows one of these slides. The mill itself is painted on the fixed glass, and the sails on the movable glass. When the little handle, A, is turned, it works the pinion, B, which rotates the circular glass, and thus makes the sails of the windmill go round. Of course, the axle of the sails must be in the exact centre of the glass. The pinion works in a rackwork ring which is cemented to the upper edge of the movable glass. A little brass peg, C, prevents the glasses from falling out of the frame. A paper or thin cardboard ring should be interposed between the glasses to prevent them from touching. It ought to be gummed on to the fixed glass.

The Chromatrope, sometimes called the Chinese Fireworks Effect, is a never-ending source of delight, particularly to the young folks. It is produced by painting a geometrical pattern on two glass discs, to which the above-mentioned rackwork rings have been fixed. The discs are mounted in a frame with the rings turned inwards, so that the pinion will work them both at a uniform rate, but in opposite directions. A very brilliant effect, varying according to the rate at which the handle is turned, will then be produced. It is usual to have a number of different designs painted in duplicate on a set of discs (which can be shown in the one frame) so as to produce a series of effects. The designs should be painted in bright colours and spiral figures, as those which radiate from the centre are generally the most effective. It is better to paint them in pairs and to show them together, rather than to have a separate design on each disc. Fig. 61 is a representation of one of these chromatrope slides.

I should mention that the frames for all these effects are made of well-seasoned mahogany, and are generally about 7 inches long by $4\frac{1}{4}$ inches wide. The figures show clearly enough how they are made, and a description of them in detail will be unnecessary. Those, however, who find any difficulty—though it is unlikely that anyone will do so—may easily remove it by a few minutes' inspection of a frame of this kind.

(*To be continued.*)

PRACTICAL SCENE-PAINTING FOR AMATEURS.

By HENRY L. BENWELL.

XXII.—CUT CLOTHS (*Continued*)—SET-PIECES—GROUND ROWS.

IN Fig. 114 will be found the specimen cut cloth promised in the last chapter, which is engraved from a somewhat larger coloured design which the writer had by him. The white squares in the portcullis should be cut away, and the canvas stiffened at back with gauze, when we have a most effective scene, especially if there is a view of the open country and hills beyond, looking over a drawbridge or battlement.

We next turn our attention to set-pieces, and here the artist has a very wide field before him, but one which he would do well to use with the utmost caution and discretion. The multitude of objects in a picture which may be taken from the view on the backcloth, and made to stand out more boldly from the background and far distance, are so varied and numerous that it is useless on our part to waste time in making a selection. But, as on the other hand, there are certain set-pieces which are always handy when kept in readiness, and serve for such a multitude of scenes, it will, perhaps, be not amiss if we select a few of the most useful of these "stock" pieces for illustration and description in the present chapter. As space, however, is limited, and as numerous drawings of set-pieces have already appeared, all of which can be used one with the other in different scenes, and not necessarily confined to the designs as given, we must content ourselves by giving but a few extra drawings as specimen designs of this portion of our work.

In the last chapter when commenting on the cut cloth which represents some abbey ruins, I drew attention to some set-pieces which would prove suitable to go with it. These will be found given at Figs. 115 and 116, but, of course, it will be found necessary to utilize other pieces of a similar character in finishing off a set scene of this character. The specimens here given will be sufficient to indicate their character and general treatment, but do not overcrowd the stage. A few heaps of stones, a cross, and an old grave stone near the wings, will be quite sufficient; of course, the wings may be painted to match the scenery, and may consist partly of ruined masonry and partly of foliage, such as ivy and other trailing plants.

The house-piece, Fig. 117, and, indeed, anything in this line, will be found the most useful set-pieces a manager can keep in stock, for they will be in constant demand in all sorts of plays. We have selected to give here a rustic cottage with thatch roof as being a subject which will become a favourite with amateurs,

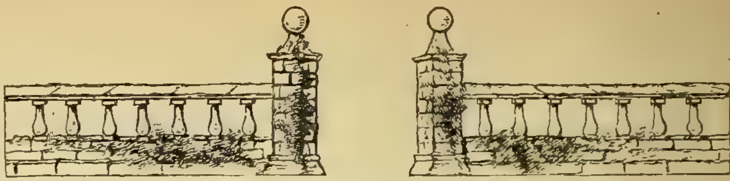


FIG. 119.—SET-PIECE—TERRACE IN GARDEN SCENE.

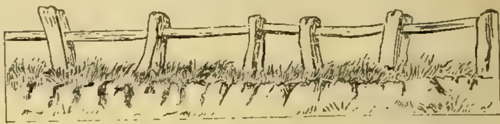


FIG. 122.—SET-PIECE—ROCKY BANK WITH GRASS TOP AND RAILS.

FIG. 123.—SET-PIECE OR "RAKING" PIECE—ROCKS.

FIG. 120.—SET-PIECE—SIDES TO STONE STEPS (TWO REQUIRED).

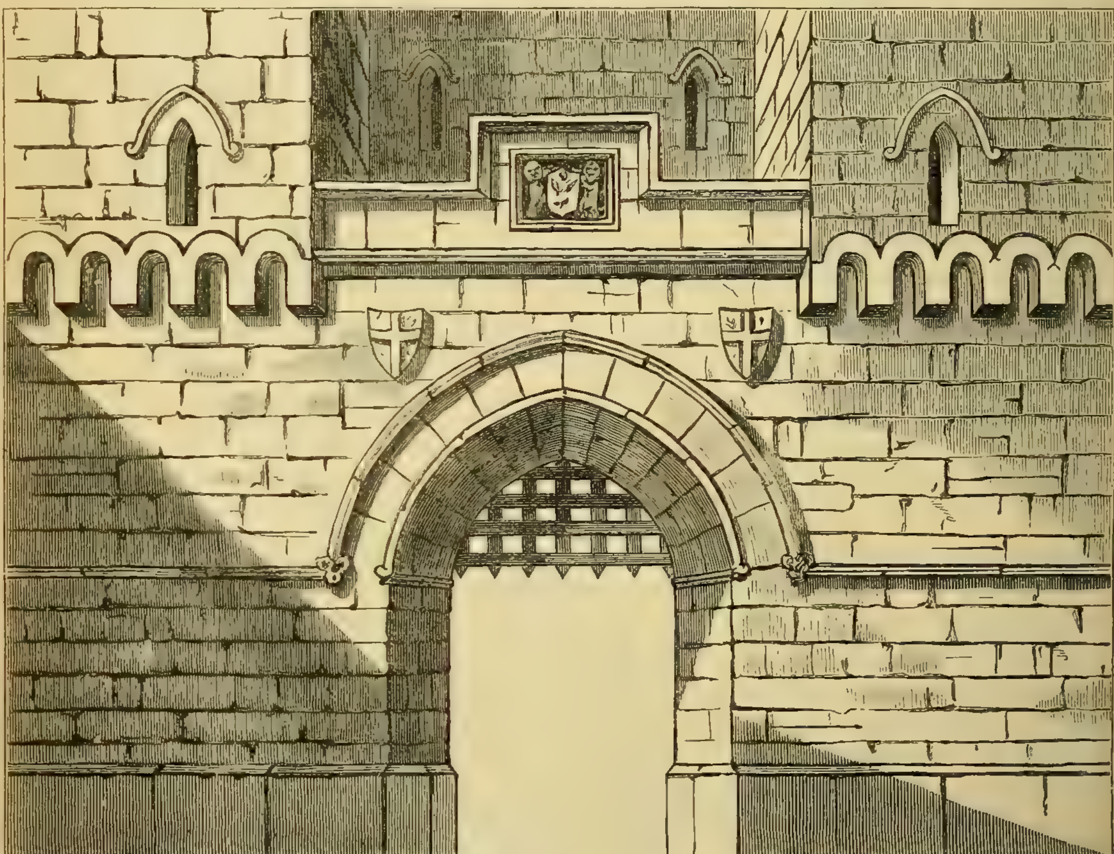


FIG. 114.—CUT CLOTH REPRESENTING ENTRANCE TO CASTLE WITH PORTCULLIS.

WARD, LOCK AND CO., WARWICK HOUSE, SALISBURY SQUARE, LONDON, E.C.

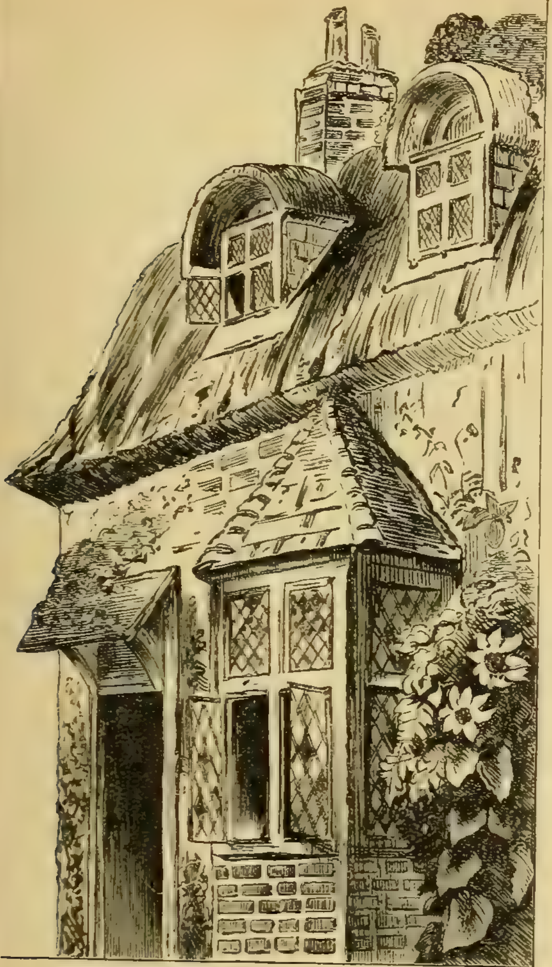


FIG. 117.—SET PIECE—COTTAGE WITH THATCH RCOF.

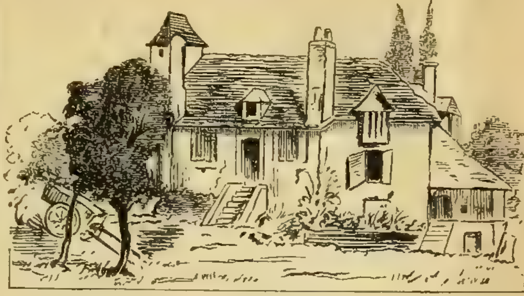


FIG. 118.—SET-PIECE TO BE PLACED BEFORE LANDSCAPE BACK CLOTH.

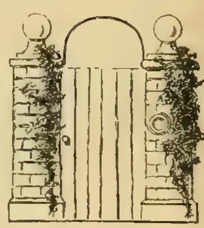


FIG. 121.—SET-PIECE—ENTRANCE GATE.

FIG. 116.—SET-PIECE—RUIN

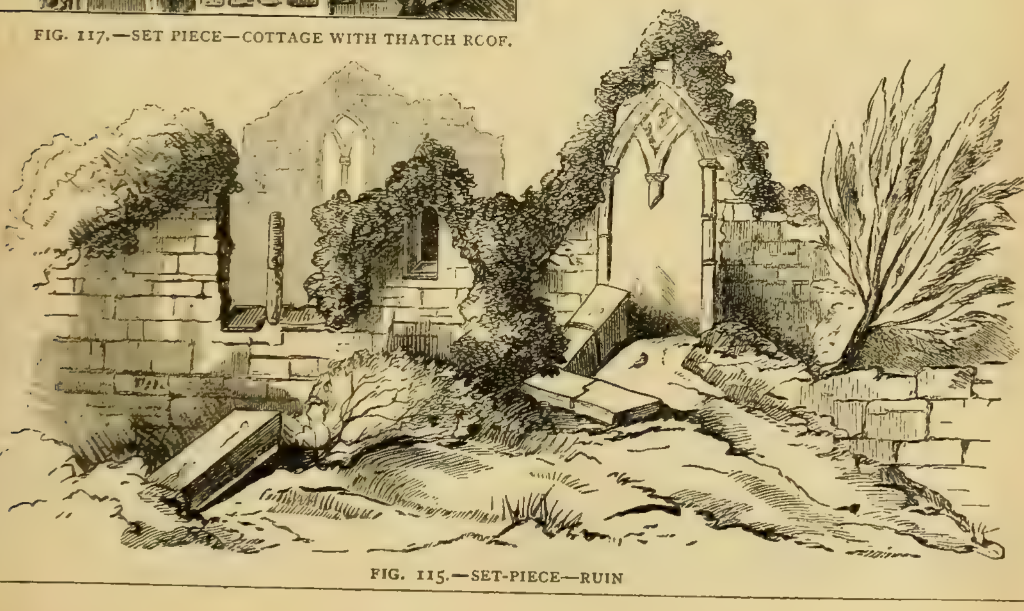


FIG. 115.—SET-PIECE—RUIN

and requires but bold treatment to make it a pretty and effective piece of painting. The doors and windows may be made practicable or otherwise ; it had better be the former, however, or half the value will be gone, unless the door at least can be used. It will at once become apparent to readers that the cottage drawing would not do to use in a street scene, it would therefore be as well to paint a suitable house-piece for using either with a modern garden set, and again in connection with street wings and cloth. There are also ancient and foreign house-pieces required sometimes, all of which should be carefully designed and painted to order. It is as well to mention that Fig. 117 can only be used on the "prompt" side of the stage, and as set-pieces are required on both sides as occasion may arise, it will be found very handy if another set-piece of this class is painted ; or, better still, for amateurs to have—whilst following the outline of the roof, and arranging the doors and windows to come in with the framework—a totally different subject painted on the reverse side of Fig. 117. By holding this page up to the light and looking at the back of the drawing, the reader will perceive that the perspective lines, etc., will be near enough correct whichever side of the stage the piece is set on.

In Fig. 118 we have a specimen of a rather antiquated dodge which was in days gone by much in vogue in provincial theatres, indeed, it is a great question whether an artist would now be found who still uses this method of scenic illusion. The sketch here given is simply intended to stand about 18 inches in front of a landscape back cloth, such as an open expanse of country with some trees and foliage in the foreground, so that when a village scene is required, it saves painting a back cloth with a village view upon it. Sometimes, however, we have seen these set-pieces used in front of cloths which have houses painted on them, in order to get an occasional change of scene. We are aware that it would be quite as cheap to paint a cloth as to make one of these set-pieces, but in the old theatres the stage overhead—there were no flies and gridirons in those days—was, as a rule, so overcrowded with drop scenes which were always kept hung, that it was almost an impossibility to introduce any new ones ; thus it was that recourse was had to set pieces which ran right across the stage after the manner of Fig. 118. This sketch, it may be mentioned, is very similar in design—as far as memory serves—to a painted set-piece which was but a few years back in constant use at the old Theatre Royal, Oxford, and looked then to be decidedly aged. I give it here as a specimen design because a fit-up, like our old provincial theatres, is often overcrowded with cloths, and in that case the scene-painter may still find it necessary now and again to make use of a set-piece similar in character to the one here given.

Fig. 119 will be found generally useful in garden scenes where it is necessary to introduce a terrace or raised platform. Fig. 120 are the sides to a flight of stone steps leading to the entrance door of a mansion or country house. The steps are built of wood, and should be painted white or buff colour. The house-piece must be in character, and the door made so as to be some distance off the floor. A set-piece of this description will be found very useful, and the same remark applies to Fig. 121, which generally stands back a little between a pair of tree wings. Fig. 122 is a rocky bank, which stands in front of a back cloth with a good strong light between the two. Set-pieces of this class may be painted to represent palings, wooden or iron ornamental railings on brick foundation, with gate in the centre. A brick wall and gate, a hedge with practicable stile, a stone wall with a field gate in centre, and many similar designs.

Other useful stock set-pieces are rocks (Fig. 123), which may be painted in great variety, also grassy banks to be used in conjunction with tree wings. These latter are sometimes called "raking" pieces, and are used to mask slanting platforms or a low flight of steps on which the actors go "on" and "off." There are a great many other useful stock set-pieces which space forbids us to illustrate and describe, among them being—gravestones, milestones, public-house or London gin palace (exterior) with transparent windows and bracket lamps for use in street night scenes, such as the view of Westminster Bridge and the Houses of Parliament in "Alone in London." Again, there are street pillar-lamps and letter boxes, trunks of trees and timber logs, which are very useful, and many others too numerous to mention.

Ground Rows should only be used on a limited scale, especially on a small stage, otherwise they impede the action of the piece ; those most used are water and rock rows, used conjointly with a sea view, and are so arranged as to bring the water a little down the stage, the rocks or other device being meant to resemble the shore or beach ; if these are cleverly painted the illusion is sometimes very successful, but, generally speaking, it is a dire failure. Gauze stretched on frames make the best water rows, and in scenes where a boat comes on or a person is rescued from drowning, as in "The Colleen Bawn," these are the only description of ground rows which can be used. When properly made and arranged on the stage, the drowning person appearing and disappearing has a most realistic appearance, and in a future series I hope to describe the method of making these rows and setting them on the stage.

(*To be continued.*)

A NOVEL TABLE WHATNOT OR ETAGÈRE
FOR CHINA OR BRIC-A-BRAC.
By J. W. GLEESON-WHITE.

(*For Illustrations, see Folding Sheet issued with this Part.*)

A WHATNOT for Bric-à-Brac. It would be hard to find two words more vague in their meanings than these two. Whatnot, strictly though its use be limited to a certain series of shelves for the drawing-room, shows that the word itself is as full of possibilities as the future; while bric-à-brac includes everything that one person throws away and another picks up and cherishes. If we, who love collecting the odds and ends of past centuries, could only secure what they literally threw away, how happy should not we be. Fancy the old oak and brass destroyed and discarded, when the nineteenth century brought (perhaps as a set-off against its many good inventions) an epoch of veneer and electro plate. The collectors of future centuries will hardly lament this period being lost, one would fancy; for it is quite certain that a great proportion of our furniture can never become antique, for the best of reasons: much of it can hardly survive the journey from the warehouse to the home without losing some of its beauty and freshness; and the electro plate is usually of such hideous shapes, that once its brilliancy has vanished, but few in any age could discover aught worth admiring in it. But it is not a maudlin sentimental regret of the past, only too easy to acquire, we lament the loss of good honest work and skilled labour, as well as its art-handiwork; and we may be sure that whatever we moderns make strong, lasting, and adapted to its purpose, will keep a charm of its own, however fashions change and times alter.

Here I pause, to confess that a more crushing argument against fretwork could hardly be drawn up. It is not lasting, save with great care, and not as a rule particularly adapted to its purpose. So we must each of us, in this respect, follow the example of Hudibras and his compeers, whose practice it was to

"Compound for sins they are inclined to,
By damning those they have no mind to!"

and somehow or other, as we mostly do, I think, when duty and conscience are too severe for us to obey, discover a way to indulge our taste and evade the logical sequence which forbids all these minor arts and trivial ephemera to exist.

But we all now-a-days are apt, too often, to go to extremes, and forget that, after all, our actual span is very brief, and that if a thing lasts a few years, it will probably outlive, I will not say (like a sermon) many present, but our taste as it was when we secured it; for our taste progresses, "whether from good to better, or bad to worse, what matters, so long as it is progress," says the cleverest little book of the period. Those of us who study AMATEUR WORK, have certainly ourselves to blame if we choose the latter, and seriously the literature of the day to all who read more than mere fiction (and they get many a lecture in disguise, for that very reason perhaps more often attended to) must gradually improve our taste, and by taste is meant, not so much an absolute hard and fast line, but a standard to judge each thing in proportion to its merits. Thus one may discover in a trifle, enough fancy or grace to atone for its existence, while if judged by strict rules, it trangresses every one of them.

And now having tried to apologise for the little piece of fretwork this article professes to describe, it may be as well for to own that the shape is from the East, whether China or Japan I am not sure, but one, or both, of those countries send over pretty lacquer etagères in sets, which stand one on the other in diminishing size, sometimes rising many feet in height and being formed of a dozen or more, each one of which fitting exactly in its next neighbour, is capable of being parted entire, in the space which the largest occupies; this feature I have not preserved, neither in this case have I planned it to stand on the floor. The brush of the early housemaid would catch, not the proverbial first worm, but a far more utter catastrophe if it assailed the lower story of a fretwork structure, seven or eight feet in height, unless planned with a special foresight of the danger; this would take so much room, that the space devoted in AMATEUR WORK would be insufficient to display it on one Supplement. Besides, I have already designed that form for other publishers, which are obtainable; but this shape is practically fresh in fretwork. I write this with diffidence, fearing that once in print and unchangeable I shall probably come across many previous ones, of whose existence I am at the present moment unaware, not having imitated the American humourist who said, "When I have a really original idea, I turn to my shelf of Greek authors, and hunt until I find who expressed it best."

But as those who may like to work it, will probably care little if it be original or not, I will repeat the old advice as to the choice of woods; they are so limited to fret cutters, that is, the suitable ones, that I can suggest nothing better than the old alternative of unpolished oak, or polished ebonised wood, which I prefer in this case, as the grain of the wood, if beautiful, is much better shown in a plain surface, and if not beautiful, only distracts the lines of the pattern and spoils both natural and applied decoration.

The wood should be mitred, mortised, or dovetailed, whichever is handiest, before working—in fact, the whole thing would be best fitted together like

three boxes without lids, before the pattern is pasted on. If this course be followed, be careful to mount the design square with the lines of the wood. Good quarter inch stuff, if dovetailed, would be strong enough, as I have left the uprights wide enough to give support. The tops may be covered with velvet, as dust shows so quickly on polished wood. The fret cutting has no unusual points of difficulty. When small round holes occur in any design, it is best to work them with a centre bit or other tool before cutting; they are cleaner and save a lot of sawing, or rather of shifting the saw so frequently.

The shape may be made triangular (the angle of a right angle for the sides), one piece of each design will suffice, and solid wood for sake of strength can be used for the other two; but if quadrangular, as shown, they must all be worked in fretcutting, to produce the effect desired. When finished, they will serve to display specimens of bric-à-brac, or other small objects which are rather lost sight of on a flat table top. And having said in so many words what ought to have been said in a few, no more now need be added concerning the Table Whatnot for Bric-à-Brac, save a wish that it may be found a successful decorative addition to the drawing-rooms of many of our readers.

REPOUSSE, OR RAISED METAL WORK.

By H. C. STANDAGE,
Author of the "Artists' Manual of Pigments," etc., etc.

VI. — LEAD BOSSING — REPOUSSE WORK PROPER — REPOUSSE WORK IN SOFT WHITE METALS.

THE details we have already given relate chiefly to the "raising" of metal by the hammer only. Repoussé differs from it only in the circumstance that a punch is used instead of hitting the metal direct with the hammer. This is so because the pattern of a piece of metal-wrought repoussé is usually of an intricate kind, with some of the details very minute. The conditions regarding the thinning, thickening, bending, etc., of the metal are precisely the same as those illustrated by the principles above specified. Instead of working on an anvil however, a bed of pitch and wax is used on which to rest the sheet of metal, sometimes a piece of thick sheet lead.

Having gained command over the metal, and force and style of blow, from the previous details, the next step will be for the tyro to try his hand at "Lead Bossing" before proceeding to execute repoussé in brass, bronze, and other metals. The writer has not practically executed any work in sheet lead; therefore, for the following description his apology is due to Mr. W. N. Brown, author of "Repoussé Work, Working in Brass," etc. :—

"Having the tools and the lead, the bosser has to fix the latter to some kind of bed. This may be of the same material as for brass repoussé—namely, soft wood or pitch; but taking it altogether, wood is by far the best for lead work. Take then a piece of soft pine, one inch boarding, rejecting such as contain any knots or shakes, and fix the sheet of lead flat upon it, previously planing up the board quite level. It is best not to nail the lead to the wood, because as the lead is bossed in the centre, there is an inclination to contract, and tear the edges away from the nails. A better plan is to fix the metal by nailing or screwing—the latter for preference—some bits of lath to the board around it (as shown in Fig. 33), which will secure the lead sufficiently firm, and yet permit any slight motion as that to which I have already alluded. If desired, the wood can be covered with green baize, which will impart still more elasticity, though I do not advise it, as the perfectly smooth surface of the block should do amply well. Instead of covering it over with an elaborate pattern, the first time the tools are handled, the beginner will find that he will make much more real and rapid progress if he will go carefully through a graduated course of preparatory exercises, taking his hammer and punch, and with their means executing straight lines, curves, squares, triangles, circles, and other simple mathematical figures.

"When he is about to execute real bossed lead work, the first thing to be done is to transfer or place the pattern on the back of the lead. If the student draws the design direct, this may be effected with a sharp point, such as a stout needle, a bodkin, or the tang of a file, or the pattern may be drawn on thin paper, and pasted (reversed) on the leaden sheet. The first plan is, however, the better.

I will suppose that it is desired to produce a square Gothic panel in relief, with a plain shield in the centre, upon which an inscription or monogram can afterwards be cut. Tablets of this kind are useful for a variety of purposes, and in the later middle ages coffin plates were not infrequently thus produced.

The operator traces the principal lines with the curved or straight tracer, as may be the more convenient, and then taking one of the round or oval-ended bosses (*i.e.*, a punch with a flat head, circular or oval, is convenient for this) commence to hammer down some of the more salient or projecting portions of the design. The position of the hands in doing this is shown at Fig. 34. When at work it is best to commence hammering at the middle of the depression, and finish at the sides or edges. These

bossing tools should be kept in various sizes, and selected as circumstances may require—a handy number being a dozen. Two are shown in Fig. 35. When the workman has sunk the whole of the design to an extent which satisfies him that he has gained sufficient relief, the sheet of lead should be removed, the hollow back filled with melted pitch, and the whole set by to become dry and hard. It is then again secured to the board, only this time with the front side uppermost, and "chased"—that is, cleaned, and the lines rendered sharp and distinct with the tools, such as are illustrated by Figs. 8, 9, and 10, assisted, if necessary, by the graver (an ordinary graver of the wood engraver). If it be a raised design with a flat background, the latter should be carefully gone over with the single pick, B (Fig. 7), or the triple pricker (Fig. 10), unless the whole of it is "matted," or rendered rough, regularly. Some workmen prefer to fasten the lead plates on a surface of pitch instead of the pine plank. When this is preferred, the composition can be made of 20 parts of good pitch, 1 of Russian tallow, and 2 of fine plaster of Paris powder, melted together in an iron ladle or pot. If it is too soft, add more pitch, and re-melt; and if too hard, put in a little more grease, and re-melt.

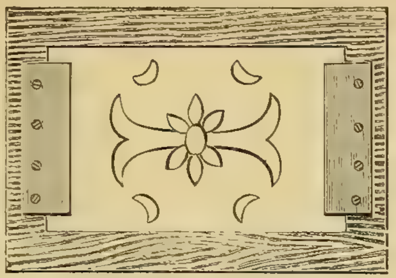


FIG. 33.—MODE OF SECURING METAL TO BOARD.

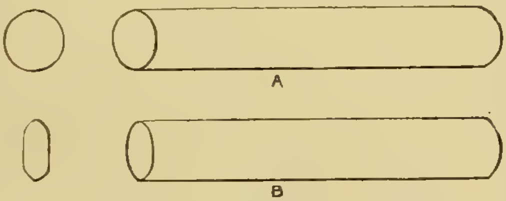


FIG. 35.—PUNCHES USED IN LEAD BOSSING.

If it be desired to back up the bossed design, so that it shall be solid—which is to be recommended—add 25 per cent. of bismuth to a quantity of lead. This will give a compound that will melt at a lower temperature than will pure lead. Try the lead in the ladle with a bit of white paper, and then pour the compound into the back of the work. If the work be very fine and delicate, add more bismuth than lead, which forms an exceedingly easy and artistic recreation; and if the panels are moulded in plush, and framed in dark oak or mahogany frames, they form exceedingly pretty wall ornaments for a library or dining-room, while there is no reason against its taking its ancient place as a regular industry in this country. The frame should not be glazed.

In conclusion, I hope my readers will take up this long-neglected art, and make bossed lead work what it was long since—a permanent and peculiar reality in the artistic productions of England: a hope we echo and endorse—including repoussé in brass as well.

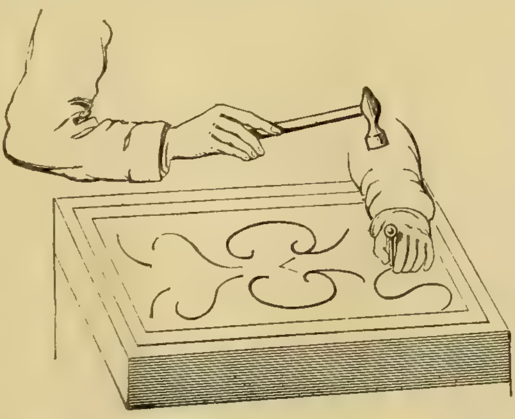


FIG. 34.—POSITION OF THE HANDS IN LEAD BOSSING.

We now turn our attention to repoussé work proper. This term—a French one—is applied to a peculiar method of ornamentation in metal, much resembling embossing; but the effect is produced by hammering up the metal, which is generally thin from the back; and when a rude resemblance to the figure to be produced is thus formed, it is worked up by pressing and chasing the front surface. Various sorts of hammers are used, with faces specially adapted for the sort of curved surface to be produced, and the anvil or bed upon which the articles are supported is shaped with reference to the same object. Every blow given with the hammer is either intended for stretching the part, as when it strikes fair upon the metal then supported upon a full bearing surface, or it is intended to bend it when it rests over an edge of the anvil, or is placed over a cavity into which it is to be driven by swaging. The great art of the workman consists in correctly estimating these effects, and bringing out the results in a sheet of uniform thickness, and with the least possible number of blows. In articles of complicated figures it is evident that long practice is required to attain this skill—*i.e.*, the size of sheet required and thickness for the production of the article. The first method of "raising" work in sheet metal is by spinning in the lathe; the second method of raising work is by means of the hammer—or by hammer and punches, *i.e.*, repoussé—by the application of circles of blows applied much in the same order as the burnisher in the first method, which acts by the gradual and continued

pressure on one circle at a time. The metal disc to be raised must be so selected as to size and thickness that it shall exactly suffice for the production of the article, leaving no excess of metal to be cut off nor deficiency to be supplied; and the blows of the hammer must be so managed as to direction and intensity, that the finished work shall be of uniform thickness throughout. In the use of the hammer for works of this kind care must be taken to distinguish between *opposed* and *solid* blows, which have the effect of stretching and thinning the metal, and in *opposed* or *hollow* blows, which tend not to stretch the metal, but rather to bend or even to thicken it. As an exercise in raising metal by the hammer only, we would advise the student to practise some such form as a saucer, then a tea-cup, and eventually more convoluted shapes. While raising work by means of the hammer and punch, I would advise flat articles, as book-clasps, round discs for button tops or sleeve-links, or a band for a bracelet. Such articles wrought in the more precious metals, say silver, would be an acceptable present for a friend, and would find a ready sale as artistic curios.

Anyone who visits a museum will find numerous designs suggested by looking at the work of not only metal workers, but even sculptors. The finest specimens of this art are of the cinque-cento, or sixteenth century period, of Benvenuto Cellini; they were generally executed in the precious metals, but copper, iron, and steel were also used, and consisted of cups, vases, and shields; and Cellini carried the art to Turin, which was, some twenty-five years ago, much developed.

A. Vechte, a Frenchman, again brought it into a degree of excellency, nearly equal to that of the Italian school in the sixteenth century. His works, exhibited in the Exhibitions of 1857 and 1862, are amongst the most remarkable art productions of the present century.

Much curious repoussé work is done in Birmingham in the soft white metals, such as pewter and Britannia metal, and as these are easily worked, and can afterwards be electrotyped so as to hide the quality of the metal, they are in considerable demand. After they are hammered up from the inside they are filled with liquid pitch, and set by until it becomes solid: they are then modelled and chased on the surface, the pitch forming a support, which prevents the tool from pressing down more than is required. The pitch is afterwards melted and drained out, and a subsequent boiling in the alkaline lye completely cleans the work. Tea-pots and coffee-pots, of various shapes and patterns, are the chief articles that are made in this manner.

(*To be continued.*)

BEE-HIVES AND BEE-FURNITURE.

By WALTER J. STANFORD.

III.—Comb Foundation—Fixing Section Foundations—Marketing, Packing, and Exhibiting Honey—Extracting Honey—Boxes above Brood Storey—Quilts—Water Troughs—Bee Veils.

NEXT comes foundation, and foundation fixing in sections. Comb foundation is (or ought to be) made out of pure beeswax, and by it the bees are saved an immense amount of time and labour, and is consequently a great gain to the master, in spite of a few croakings early last year, 1886, against it in the "Bee Journal." It has been calculated by wiser heads than mine, that twenty pounds of honey must be consumed before one pound of wax can be secreted—that is, they must eat twenty shillings to produce 2s. 2d.; evidently very bad economy, but besides this, the time is also lost in the harvest season when every fine hour is so much silver. Never therefore let any man persuade you that comb foundation is a fallacy. For brood combs, it does not matter how thick the foundation is made, but six sheets (standard size) to the pound, is generally supposed to be thick enough, and that sufficient wax is thus supplied to enable the bees to draw out their combs to the full size. The wax is pressed in sheets through accurately engraved rollers, and a facsimile of the base of a natural comb is thus formed. Nothing but *pure beeswax* should be used.

There are several paraffin imitations. Baldwin's is splendid foundation at 2s. 2d. per pound. Section foundation is made of a much finer class of wax and very thin. A little triangular strip in each section to start the bees is all that is necessary. On no account use a piece the full size of the section; customers don't like it, and you help to ruin the demand for pure honey. How to fix section foundation is the next question. First settle once and for ever which shall be the top and which the bottom of all sections. Sections to keep during the winter must be stored right side up, that is, as they stood when built by the bees, and unless you are positive which side was uppermost when the empty section was put into the rack, you will always be making mistakes. Having cut several triangles of super foundation about $1\frac{1}{2}$ inch equilateral—to fix a piece in the top of each section, Parker's foundation fixer, Fig. 30, is invaluable. To make it, get a piece of hard wood 1 in. by 4 in. by $1\frac{1}{8}$ in., and cut a handle as Fig. 31. The handle part is 6 in. long. Write "top" and "bottom" on the two flat sides, and run a gauged line $\frac{7}{8}$ in. away from the end across the grain on the "bottom," and another $\frac{1}{8}$ in. from the "bottom" along the $1\frac{1}{8}$ in. thick end and

shave off the bevel. Make a good bold ornamental bevel on the top side, and slope and chamfer for appearance the joint between the handle and the blade. Find a point $1\frac{1}{2}$ inch away from the blade end and $\frac{5}{4}$ inch from the top, and bore for an inch screw on both sides. To make the base, Fig. 32, get a piece of hard wood 11 inches by 4 inches by $\frac{3}{4}$ inch, and two pieces of any wood $3\frac{3}{4}$ inches by $1\frac{1}{4}$ inch by $\frac{5}{8}$ inch. Cut a rebate of full $\frac{1}{8}$ inch by $\frac{3}{8}$ inch in each, and nail them on either side; $3\frac{1}{2}$ inches from the front end, nail a thin strip across to act as a stop, and exactly in the centre of the thickness of the base $4\frac{1}{2}$ inches from the front on either side bore for a screw.

Get two pieces of galvanised iron cut to the exact size of Fig. 33 out of $\frac{1}{16}$ inch iron, two screw holes in each to act as hinges. Screw the whole thing up. To use it, first firmly screw it to the bench by a screw before and behind. It is hopeless trying to work it if it isn't firmly fixed. Now rub a very little butter or honey on the bottom bevel, and put a section with its top on the base against the stop. Lay an edge of one of the triangles of foundation under the buttered bevel. With the right hand and firm pressure rise and draw back the lever, pressing the foundation into the section (the butter prevents it sticking to the lever), while with the left hand you turn the piece up at right angles. It will be found to be firmly stuck if the section was quite dry. Butter need only be applied for every 30 or 40 sections. Dividers must be used between the rows of sections in all racks, if you intend to glaze afterwards, otherwise the sections are built beyond the edges of the wood, and sometimes the bees will join two together, spoiling their selling appearance and value very much thereby. Dividers are made either of tin or of very thin wood about 14 inches long by 4 inches wide, the wooden ones are cheaper, though tin is, I think, better for the purpose. The wooden ones can be bought for 3d. a dozen from all dealers. One of the essential points for the honey producer to consider, is how he can best sell his honey, and therefore his aim should be to "get up" all honey as neatly and attractively as possible. I cover both sides of all my sections with pieces of glass $4\frac{1}{4}$ inches square, and hold them on by a long strip of nice white paper pasted round the wood with its edges on both sides turned $\frac{1}{4}$ inch over the glass. A neat honey label gummed on the upper side makes the whole look very tasty.

For marketing section honey in, Fig. 34 is a very useful arrangement. Fig. 34 is made to hold one dozen glazed sections, and is simply a small box of inside dimensions 13 inches by $6\frac{3}{4}$ inches by $4\frac{1}{4}$ inches, with two $1\frac{1}{2}$ inch and $\frac{3}{8}$ inch laths screwed on one side and nailed on the other. The sections are put in or taken out by unscrewing the laths. Four screws altogether will be sufficient, and they should not be too long. These crates are generally made with a pane of glass on each side, but if the sections are glazed, this is unnecessary.

For packing honey to send to friends, a very simple crate can be knocked up in a hurry to hold the required number of sections or bottles. Fig. 35 is a size for four sections, and I think speaks for itself. People will generally return them, and they are very handy things to have on an emergency.

For exhibiting honey at shows, I don't think you could have anything better than Fig. 36. It is made of $\frac{1}{2}$ inch pine as a mitred box 2 feet $7\frac{1}{2}$ inches by $14\frac{1}{2}$ inches by $2\frac{3}{4}$ inches, and is divided by $\frac{3}{8}$ inch uprights and horizontals into nine partitions. The three central ones hold three sections each, and the outside ones two each, or twenty-one altogether. The shelves and uprights are halved into each other where they meet, and let $\frac{3}{16}$ inch into the main walls of the rack. Before glueing together, the upper sides of the shelves, both sides of the two upright dividers, and the inside of the bottom and two vertical walls are veneered with walnut veneer. The other insides can't be seen, and veneer needn't be wasted on them. The whole can now be glued up. Clean off the outside, size and veneer it similarly. The bottom need not, of course, be done. Fig. 37 shows a longitudinal section of the feet with dimensions. This should be made out of solid walnut about 1 inch thick. The rack is let into them and secured by two screws in each, underneath. The whole outside should be polished. The benefit of this arrangement is that both sides of every section can be seen at a glance, a great boon to judges. The effect also is striking. I designed it in 1885 for the Dublin October show, but never used it. I have, however, now made three different sizes, and they will probably appear at the next Irish show; but as far as I know, the design has never been used at an English show.

Having now fully discussed section honey and its accessories, extracted honey, as far as woodwork is concerned, must have its share. It is very hard to say which is the most profitable. I work all stocks for both, but in many apiaries special hives are built, and set aside for extracting from. The special construction required for such hives is simple. A second story is all that is required similar to the brood nest. Cowan gives the principles of extracting, and as this paper is not meant to discuss management more than I can help, I cannot say here all I would like to say on the subject. The upper story and sometimes stories sit over the brood nest inside the outer case, but quite separate. They may be made quite roughly from $\frac{3}{4}$ inch white deal. Make a box of inside dimensions 21 inches by $16\frac{1}{4}$ inches by $8\frac{3}{4}$ inches, but before

nailing it together, run a rebate ⅜ inch wide and ⅞ inch deep along the top inside of both long sides; this is to give the 17 inches in length for the top bars. Nail it up and pack up the inside width to 14½ inches exactly as done in the brood nest, trough and all. This is all that is necessary, except to nail four little pieces at both ends of each rebate to prevent bees getting out in the space left there by cutting the rebate. No queen excluder is wanted between the two stories. Full sheets of foundation should be given in the frames. A super of sections can always be put above this again if the bees require it. Another and a much better plan for the same purpose, is to make a second brood nest, precisely similar in every detail to the first one, described in the last paper, so that they shall be completely interchangeable with one another. A little dodging in the arranging of a movable plinth in front, and a stop for the entrance in the upper (for the time) storey, is all that is necessary. For carrying combs between the hives and extracting

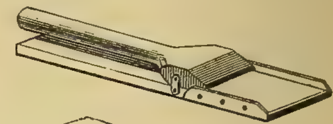


FIG. 30.—PARKER'S SECTION FOUNDATION FIXER.

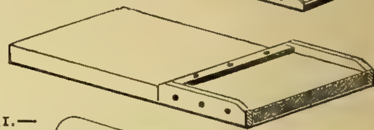


FIG. 32.—BASE FOR FIXER.

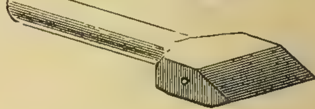


FIG. 31.—HANDLE FOR FIXER.

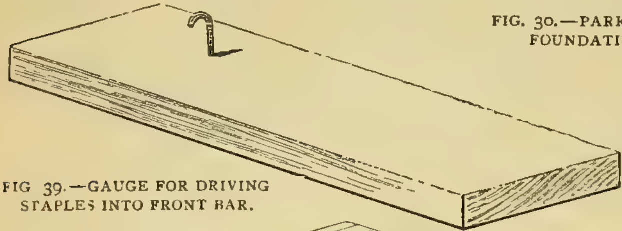


FIG 39.—GAUGE FOR DRIVING STAPLES INTO FRONT BAR.

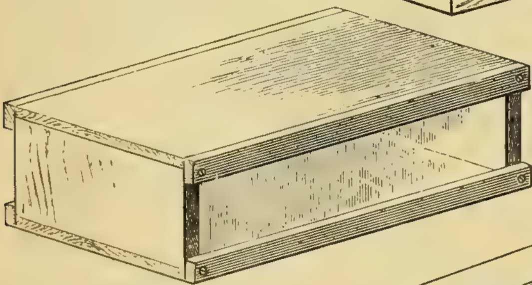


FIG. 34.—SECTION MARKET CRATE.

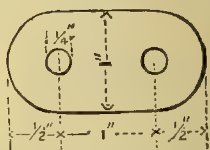


FIG. 33.—HINGE FOR FIXER—HALF SIZE.

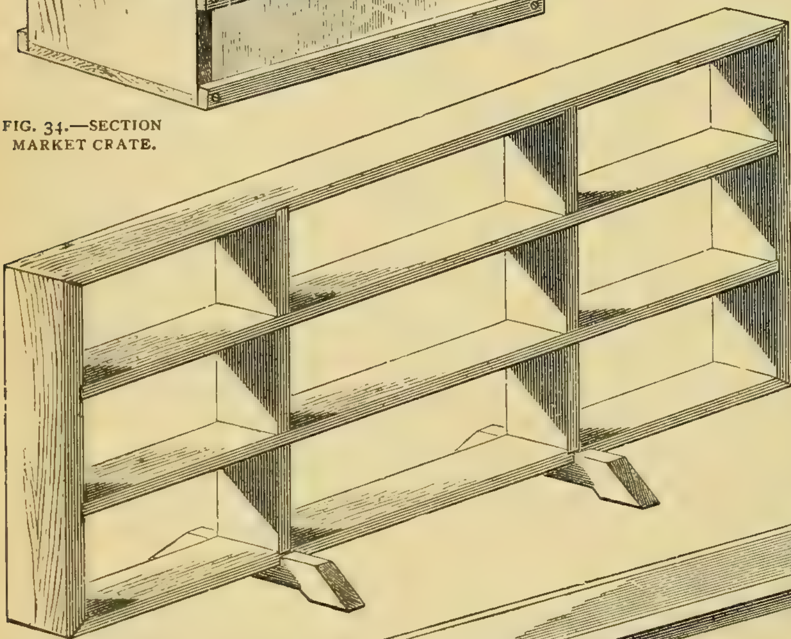


FIG. 36.—SHOW RACK.

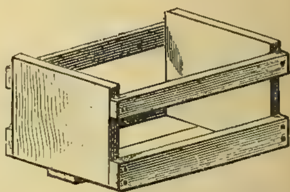


FIG. 35.—PACKING CASE.

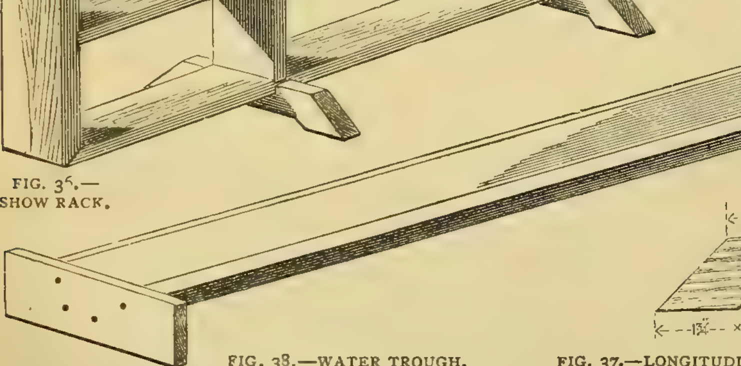
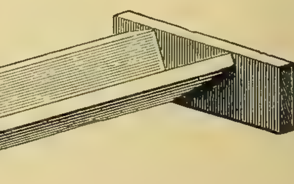



FIG. 38.—WATER TROUGH.

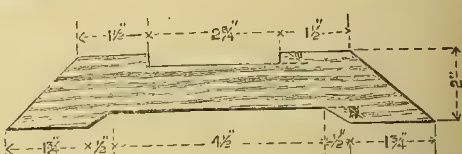


FIG. 37.—LONGITUDINAL SECTION OF FEET FOR SHOW RACK.

house, a comb-box is necessary, and is also useful when manipulating or looking for the queen to put combs that have been examined into. A box $14\frac{1}{2}$ inches wide by $8\frac{1}{2}$ inches deep, with a bottom but no top, and about 20 inches long, answers the purpose best. A light cloth thrown over the top serves as a cover and protection from bees. It should be made as light as possible, and a handle to carry it with one hand arranged. This is easily done, by driving in four medium-sized staples near the top of the box; two pieces of stiff wire are fastened to them in a loop across the box. Finer wire then can be bound round the two in the middle to form one stiff handle.

Quilts must be provided for every hive, and they are best made out of strong hemp carpet. You will want two thicknesses covering the whole of the top of the brood nest; also a piece of the same size with the centre cut out so as to leave a rim of 2 inches all round, must be used between a section rack and the brood nest. Besides the carpet, a piece of unglazed American cloth must be used in the spring and summer over the brood nest. The hive moisture condenses on the smooth side, and the bees use it advantageously for drinking purposes. Water outside must be supplied in little troughs filled with small stones, in addition to this. Such a trough is easily made by taking two pieces of 1 inch deal, one 3 inches wide and the other 2 inches, and nailing them at right angles to each other, making a white lead joint. Two rectangular pieces nailed on with white lead at the ends form a trough, and enables the structure to stand in a position suitable for holding water; Fig. 38 shows such a trough 3 feet long. Feed holes must be cut in the quilts (unless Hole's dummy feeder, to be afterwards described, is to be used), that is, a circle of about $1\frac{1}{2}$ inch in diameter should be cut in the transverse centre of the quilts, but they should be out of the longitudinal centre, so that when the feeders are not in use by reversing the top thickness the hole is covered. A flap should not be left when cutting the hole in the enamel cloth, so as to form a sort of hinge by which the piece will close the hole again if necessary. For autumn feeding, a crown board or board corresponding to the quilts with a similar hole is very useful. It should have pieces tongued and grooved across the grain to prevent its warping. A bee veil to protect your face is very necessary. I will copy Mr. Cowan's recipe for making it: "It should be of coarse black net, 1 yard by 18 inches being sufficient. Fasten the ends together, run a hem round the top and insert an elastic, and draw it up until it fits round the crown of a hat. The rim of the hat keeps the veil from the face, and the lower end can be tucked in under the coat about the neck." For better protection, I have stitched an iron hoop into mine on a level with my nose to keep it well away from my face.

I have now, I think, completed all but the metal furniture, and designs and details for an extracting house, which is a very necessary part of an apiary.

(*To be continued.*)

SMITHING AND FORGING.

By GEORGE EDWINSON.

XII.—WHEEL TIRES—BOX KEYS—USEFUL MEMORANDA—(CONCLUSION).

TIREING WHEELS.—Wheels of road vehicles are bound with rings of iron, and these rings are named tires. In large coach and carriage-making establishments, the manufacture of tires is either a separate branch of the business, with special tools and machines set apart for the use of the tire smiths, or it is one of the accomplishments of the coach-smith, if he happens to be well up in his trade. Although the country amateur smith may not aspire to a full knowledge of coach-smithing, it is most important that he should know how to tire a cart-wheel, or, at least, the wheel of a wheelbarrow or a perambulator.

Cart and waggon wheels are tired with flat bar iron of suitable dimensions to the size and weight of the wheel. The tire should always be wide enough to bring its edges flush with those of the rims of the felloes, and of sufficient thickness to stand the wear and tear to which the wheel will be subjected. For example, the wheel of a light cart with felloes $1\frac{1}{2}$ inches in width across the rim, should be tired with $1\frac{1}{2}$ by $\frac{1}{2}$ inch flat bar iron. The first thing to be done with the selected iron will be to measure off the required length for the tire, and this is done in the following manner. A bar of the iron is laid on the smithy floor, and the length is run off from the circumference of the wheel to be tired, by running the wheel along the bar and marking it with a piece of chalk. Place the wheel on the end of the tire bar, and mark the felloe with a piece of chalk just where it touches the end of the bar. Roll the wheel along until one of the felloe joints touches the bar, then mark the bar just where the joint touches it, and mark the position of each joint in a similar manner on the bar as the wheel is rolled along. When the chalk mark on the wheel comes around to the bar again, the required length of the tire will have been measured off by the circumference of the wheel, and at this point another chalk mark is put on the bar to mark the dead length of the tire. If the iron is cut off here, it will probably be found too short when

the tire is bent, because it will contract in bending, so we allow about one inch more, and mark it with a chisel at this point for cutting off. The nail holes must next be marked with a centre punch, from 1 to 1½ inches on each side of the felloe joint marks, and the tire cut off at the chisel mark when it is ready for the bending process, which is done on the cold iron.

In large establishments, tires are bent in a suitable machine, but the bending machine of a country smithy is usually a primitive affair, being merely a strong wooden post let firmly into the floor of the shop, and furnished on one side with a square staple or bridge of iron near the top. As wood is liable to yield to the pressure of iron and lose its convex shape, the top of the post is bound with a broad iron band, and the tire is bent by passing its end under the bridge and pressing the long part against the convex head of the pillar until a short length has been bent to the required radius. This length is pushed through the bridge and another length bent, and so on, until only a short straight piece is left, too short to allow a leverage. This end is then caught in the jaws of a pair of stout tongs, a link is forced on the handles, and this is used as a lever. Even then, there will be found a piece at each end not bent enough, and these must be finished off on the beak of the anvil, where the hooped tire will be given the few last touches needed to perfect its shape. Some smiths make for themselves a tire-bending tool by bending a stout piece of iron into a convex form, welding a smaller piece to this to form a bridge, and fastening the tool firmly to a wall or to a stout pillar of wood by means of bolts and stays. In shops where much tireing is done, a wheel-plate is laid down, that is, a large disc of stout sheet iron with a hole cut in the centre is bedded perfectly level on a part of the shop floor, and on this plate the wheel is laid to be tired. On this plate the tire is laid as it comes from the bending process, and is here gauged and finished perfectly round and true by means of blows given on the irregular parts, whilst these are supported against a heavy lump (named a dolly) of iron. As such plates are expensive, we must be content with a level floor on which to rest and gauge the tire.

The two ends of the hoop must now be welded together, but before this is done we must be certain that the hoop is of the exact size required, for although it was struck off from the measured circumference of the wooden wheel, it is quite possible that its size may have been altered by the blows given to put it into its proper shape. If we took the first measurement as final, the hoop might be too large when welded, and this would be a serious mistake, causing a loss of time, labour and material; for in all cases the tire must be smaller when cold, than the rim of the wheel it is intended to encircle. The known property of iron to expand and lengthen when heated, is here taken advantage of to ensure a perfect fit of the tire on the wheel; the finished tire being heated to make it slip easily on to the wood, and cooled suddenly in water to shrink it tightly in place on the felloes.

To ensure a perfect fit of the tire on the wheel, both are measured accurately with a tool named a "traveller," before the tire is welded. This tool is simply a disc of sheet iron six inches in diameter, made to run like a wheel in a forked handle. The hole in the centre of this disc should fit the pin on which it works, and the prongs of the fork should be close to the sides of the disc to prevent wobbling. To use this tool, proceed as follows:—

Lay the wheel to be tired on the anvil, and put a bolt through the hole in its nave into the hole in the anvil, arranging it so as to be easily spun round with the left hand, whilst the "traveller" is held to its edge in the right hand. Put a chalk mark on the edge of the wheel and a notch with a file in that of the "traveller." Place the notch on the chalk mark, hold the tool to the wheel, and spin this around until the "traveller" again reaches the chalk mark, then make a chalk mark on the "traveller" in a line with the chalk mark on the wheel. Now apply the tool to the *inside* of the bent tire. Place the starting notch exactly coincident with the end of the hoop and run the traveller around the *inside* to the other end, when, if the tire is exactly the same size as the rim of the wheel, the chalk mark on the traveller will coincide with the other end of the hoop. If the chalk mark comes on the tire, short of the end, it will show that the tire is too long, and the superfluous iron indicated must be cut off to make it exactly the same size as the rim of the wheel. If we now scarfed the two ends for welding, the tire would be still too large, because it must be slightly smaller than the wheel before it is heated; we therefore make the ends hot, cut off about half an inch from each of the four corners, and then scarf the two ends with a sett-hammer, or fuller, ready for welding. If the traveller shows that the tire is a little too short, the corners must not be cut off before the ends are scarfed. When the ends are scarfed, bend them sufficient to give them a little spring, and so make them cling together, heat up to a welding heat and close them on the beak of the anvil. Next take a good welding heat and finish the weld. When this is done, run the traveller around the inside, when it should show the tire to be from ½ inch to ⅞ inch smaller than the wheel; according to size of wheel and condition of its felloes, a large wheel and one with felloe joints left

open should have a proportionately smaller tire than a small wheel with close joints.

The tire must next be prepared for the wheel, and this to receive the tire. The tire must be made uniformly red hot all over before it is put on the wheel. It will not do to have it red hot in one part and black hot in another, for this inequality in temperature will cause unequal shrinkage and consequent warping.

In coach-making shops a large furnace is provided in which the tires can be uniformly heated ; but smiths in a small way of business heat up the tires in their own forge fires, and adopt special precautions to ensure a uniform heat. A large fire is made up and the forge hearth cleared of tools and made level with cinders. On this is placed the tire, covered thickly with such rubbish as wood chips, sawdust and shavings, or chaff from a winnowing machine, dried weeds from the garden or field, or couch grass from a farm. As the tire is heated, it is turned around inward into its covering of rubbish, and the work goes on of heating and turning, first slowly then more quickly, until the tire is seen to emerge from the rubbish in a red hot condition, and the whole heap is fairly alight.

Meanwhile the wheel should be securely fastened down to the wheel-plate or on a level floor with its back side uppermost. Under the rim at several points should be placed a few thin wedges or strips of thin iron to keep the tire from dropping down too low. A couple of dog wrenches should be laid ready to pull the tire on with, a hammer to give it a few blows if needed, and a few pails of water to dash over the tire when it is on and in its place.

The tire, being now at a uniform blood-red heat, must be taken out of the fire by two persons holding on to opposite sides with stout tongs, taken to the wheel and put on. The smith should drop his side down over the felloes first, then his assistant should drop his tongs, catch up one of the dog wrenches and try to pull his side over the rim of the felloes whilst the smith taps it here and there with a hammer, or assists with the other wrench, as required. The work should be done briskly, with decision in each movement, and without many blows or much strain on the tire. When the tire is on in its place, cool it rapidly by dashing the water over it, and when nearly cool, or cold enough to handle without scalding, take off from the wheel-plate, and set the felloes in position true with the tire by giving them a few blows where needed with a wooden mallet.

The holes for the tire nails may be drilled before the tire is heated, and when this has been decided upon, their position must be marked with a centre-punch as before directed, and care must be taken to drop the heated tire in its proper position with regard to the nail holes and their proper places. But it is not always necessary to thus mark and drill the holes, for this can be done after the tire has been shrunk on to the wheel. Use a long taper-pointed drill, and put the holes in just enough for the *point* of the drill to go through. Finish the holes by driving in a hand punch of the required size. Tire nails are made with large bevelled heads to fit the deeply countersunk holes in the tires. Carriage and perambulator wheels are tired with half-round iron. Wheels for agricultural implements are sometimes made without felloes. In such wheels the tire ends of the spokes have iron ferrules, and these are secured to the tires with screws. Wrought iron wheels are also largely in use with this class of implements, with colonial waggons and carts, and with wheel-barrows. Fig. 291 is an illustration of a wrought-iron barrow wheel, from which it will be seen that such a wheel can be easily constructed in parts, and put together with a few rivets. Wrought-iron barrow wheels, ready made, are sold by Messrs. Bayliss, Jones, and Bayliss, *Wolverhampton*, at from £3 15s. to £4 per dozen.

Nave-Stock Hoops.—The manufacture of hoops for the nave-stocks of wheels demands a little consideration. The necessary length of iron for a hoo may be ascertained with sufficient accuracy for a practical purposes by measuring the diameter of the part to be hooped, and multiplying this by three, then add one-seventh of the diameter ; or, more correctly, by the decimal system of measurement, if we multiply 3·1416 by the diameter in inches the product will give us the exact circumference in inches and their decimal parts. This will give the dead length of iron needed to form the hoop, and it is possible to shut the two ends together by welding them flush, but it will be safer to cut the iron ½ inch longer than the dead length, upset the two ends and scarf them for welding, because of the tendency in thin iron to burn away at the edges when brought to a welding heat. Care must be taken in heating the iron to avoid burning, and the heat must be worked off quickly, for the thin iron soon cools. When finishing the weld, avoid stretching the iron on the edges by excessive hammering, for if these are stretched they will leave the middle hollow and spoil the hoop. Hoops may be made longer on one edge than on the other by thus stretching the edge, and in this way made to fit a tapering boss or cylinder.

A series of articles on " Cart and Wheel Making " were published in the *English Mechanic*, 1880-83, and there is an article on Coach Smithing in *The Smithy and Forge*, price 2s. 6d., Lockwood and Co.

How to make a Box Spanner, or Key.—Box spanners are useful tools. In one form they are known as " bed keys," and are used in extracting the screws which hold the parts of old wooden furniture together.

In other forms they are used on coach screws, in places where the heads of these screws are recessed. They are also used as turn-keys, to fit the shanks of buried taps employed in the waterworks systems of our towns and cities. A box spanner is made up of socket, shank, and handle. The tools required will be, besides the ordinary hammer and tongs, a round swage and a square ended mandrel. The materials are round iron or mild steel for the shank and handle, and flat bar iron for the socket. The size of round bar iron chosen for the shank and handle must be determined by the size of key to be made, and its use.

A bed-key will only require $\frac{3}{8}$ inch rod, a box spanner for bolts up to $\frac{3}{4}$ inch should have $\frac{1}{2}$ inch or $\frac{5}{8}$ inch rod, whilst a turn-key should have rod of not less than $\frac{3}{4}$ inch. The length of rod required will also vary with the size of spanner, from 6 inches up to 18 inches and over for the shank, and from 4 to 12 inches for the handle. A similar rule will act as a guide in the selection of flat bar iron for the socket, $1\frac{1}{2}$ by $\frac{1}{4}$ inch being thick enough and wide enough for a small key, whilst 3 inches by $\frac{1}{2}$ inch should be selected for a larger one. The length of flat iron will be determined by the size of the nut or end of spindle on which the key or spanner is to be used. Measure the head of the spindle and multiply by 4 to get the square, then add $\frac{1}{8}$ inch to each $\frac{1}{4}$ inch to provide for shrinkage in bending the iron; take for instance a $\frac{1}{2}$ inch nut, and multiply $\frac{1}{2}$ inch by 4, this will give 2 inches, or 8 quarter inches, add to this $\frac{1}{8}$ inch for each $\frac{1}{4}$ inch, and it will give a total length of 3 inches of 3 inch flat iron to be cut off to form the socket of the spanner. The square mandrel must be made of the exact size of the nut, and of uniform size over all the length intended to fit in the box socket of the spanner.

Having made this and cut off the iron, make up a good clean welding fire, and heat up the socket piece to a red heat. Bend it over a round mandrel (Fig. 292) to form a sleeve or collar, as shown Fig. 293.

Next get ready for a welding heat—have some sand near at hand to flux the iron, place the hollow round swage in its place on the tail of the anvil, and hammer and tongs near it, then heat up the sleeve to a good welding heat, throw some sand on the parts to be joined, and, when the iron is at a melting heat, quickly pull it out on to the round swage, and hammer away sharp until the edges are closely welded, forming a short tube, as shown Fig. 294.

Now take the iron for the shank, nick a mark on it to show how far it should go into the socket, place the two together in the fire, heat up to a welding heat, sprinkle some sand on the parts to be united, slip the socket on the shank, and weld both up to make a close firm joint, as shown at Fig. 295. Return to the fire, get a good heat on the socket end and proceed to alter the round hole of the socket by driving into it the square ended mandrel, Fig. 296. This must be driven in well and straight, whilst the shank is held in the vice, and it may be necessary to form the socket on the mandrel by a few blows from the hammer whilst the socket rests in the swage.

Next weld a T piece on to form a handle as shown at Fig. 297, or bend the shank to form a crank handle, as shown Fig. 298, or weld three short box keys of various sizes together to form the handy key shown at Fig. 299.

Useful Memoranda.—The following rules and tables were given in *Calvert's Mechanics' Almanack* for the year 1875:—

WEIGHT OF SHEET OR PLATE IRON PER FOOT SQUARE, SUPERFICIAL.

Thickness in parts of an in.	$\frac{1}{32}$	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$	$\frac{11}{16}$	$\frac{3}{4}$	$\frac{7}{8}$	1 in.
Weight in lbs avoirdupois.	$1\frac{1}{4}$	$2\frac{1}{2}$	5	$7\frac{1}{2}$	10	$12\frac{1}{2}$	15	$17\frac{1}{2}$	20	$22\frac{1}{2}$	25	$27\frac{1}{2}$	30	35	40

WEIGHT OF ANGLE AND T IRON BARS PER LINEAL FOOT IN POUNDS AVOIRDUPOIS.

in.		in.		in.		lbs.		lbs.
$1\frac{1}{2}$	by	$1\frac{1}{2}$	by	$\frac{1}{4}$	=	2·31	advancing	·21 for each added $\frac{1}{8}$ in.
$1\frac{1}{2}$	by	$1\frac{1}{2}$	by	$\frac{5}{16}$	=	2·82	,,	·52 and ·53 alternately each $\frac{1}{4}$ in.
$1\frac{1}{2}$	by	$1\frac{1}{2}$	by	$\frac{3}{8}$	=	3·31	,,	·63 for each added $\frac{1}{4}$ in.
$1\frac{1}{2}$	by	$1\frac{1}{2}$	by	$\frac{7}{16}$	=	3·77	,,	·74 and ·73 alternately each $\frac{1}{4}$ in.
$1\frac{1}{2}$	by	$1\frac{1}{2}$	by	$\frac{1}{2}$	=	4·20	,,	·84 for each added $\frac{1}{4}$ in.

WEIGHT AND SAFE WORKING LOAD OF IRON CHAINS.

Diameter of iron in.	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	[illegible]	$\frac{7}{8}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{3}{8}$	$1\frac{1}{2}$	$1\frac{3}{4}$	2
Weight per fathom lb.	8	14	22	32	43	56	71	87	106	120	148	180
Working load in tons	1	1·7	2·8	4	5·5	7	9	11	13·5	15	17	19·5

Here I may interpolate the following information on the weight of wrought iron, which may be useful to my readers:

TABLE FOR CALCULATING WEIGHT OF RECTANGULAR IRON.

Inches in length.		Thickness in inches.		Breadth in inches.	Weight. lb.	oz.		For each $\frac{1}{8}$ of inch added breadth. lb.	oz.
12	by	$\frac{1}{8}$	by	$\frac{1}{4}$	0	1·6	advancing	0	·8
12	by	$\frac{1}{4}$	by	$\frac{1}{2}$	0	6·6	,,	0	1·7
12	by	$\frac{3}{8}$	by	$\frac{3}{4}$	0	14·9	,,	0	2·5
12	by	$\frac{1}{2}$	by	1	1	10·4	,,	0	3·3
12	by	$\frac{5}{8}$	by	$1\frac{1}{4}$	2	9·4	,,	0	4·1
12	by	$\frac{3}{4}$	by	$1\frac{1}{2}$	3	11·6	,,	0	5·
12	by	$\frac{7}{8}$	by	$1\frac{3}{4}$	5	1·1	,,	0	5·8
12	by	1	by	2	6	10·	,,	0	6 6
									each $\frac{1}{4}$
12	by	$1\frac{1}{8}$	by	$2\frac{1}{4}$	8	6·1	,,	0	15.
12	by	$1\frac{1}{4}$	by	$2\frac{1}{2}$	10	5·6	,,	1	0·6
12	by	$1\frac{3}{8}$	by	$2\frac{3}{4}$	12	8·3	,,	1	2·2
12	by	$1\frac{1}{2}$	by	3	14	14·4	,,	1	3·9
12	by	2	by	4	26	7·9	,,	1	10·5
12	by	$2\frac{1}{2}$	by	5	41	6·4	,,	2	1·1
12	by	3	by	6	59	9·8	,,	2	7·7

The weight of fractions of the foot and inch may be easily obtained by dividing the weight per foot by

12 to ascertain the weight per inch, and multiply the weight per inch by 10 to give the weight of the decimal parts thereof in decimal parts of an ounce, then divide by 8 to get the weight of $\frac{1}{8}$ inch. Thus, suppose we have a piece of wrought iron $\frac{1}{2}$ inch by 1 inch, measuring $18\frac{1}{8}$ inches in length, and wish to know its weight. We find that 12 inches of this size weighs 26·4 oz., and this divided by 12 shows us that an inch length weighs 2·2 oz. Now if we multiply 2·2 by 10 we get $\frac{2\cdot2}{10}$ or ·22, and if we divide this by 8 we get ·275 or $\frac{275}{1000}$ of an ounce to represent the weight of $\frac{1}{8}$ in. of 1 by $\frac{1}{2}$ in. iron. The total weight of $18\frac{1}{8}$ in. would therefore be, 26·4 oz. + 13·2 oz. + ·275 oz. = 2 lb. 7·875 oz., or roughly, and near enough for practical purposes, 2 lb. $7\frac{3}{4}$ oz.

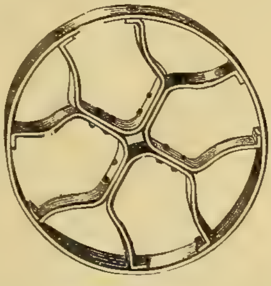


FIG. 291.—WROUGHT IRON WHEEL FOR WHEELBARROW.

Rule for Calculating the Weight of Round Iron Bars.

Multiply the square of the diameter in inches by the length in feet, and that product by 2·6. The product will be the weight in lbs. avoirdupois nearly.

Rule for Calculating the Weight of Square Iron Bars.

Multiply the area of the end of the bar in inches by the length in feet, and that by 3·32. The product will be the weight in lbs. avoirdupois nearly.

Rule to find the Breaking Weight of Chains :—

Divide the square of the diameter of one bar of the link in sixteenths of an inch, by 9.

"A chain is never stronger than its weakest link."

Gunter's Chain is composed of 100 straight links of $\frac{1}{4}$ in. iron, each 7·92 inches in length.

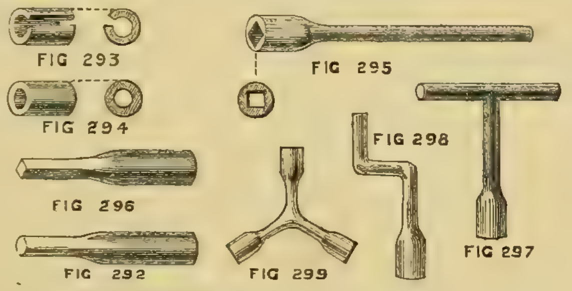


FIG. 292.—ROUND MANDREL. FIG. 293.—SLEEVE FOR SOCKET, OPEN. FIG. 294.—DO., CLOSED. FIG. 295.—SOCKET WELDED TO SHANK. FIG. 296.—SQUARE-ENDED MANDREL. FIGS. 297, 298.—KEY SPANNERS. FIG. 299.—BOX BED KEY.

Case-hardening Recipes.—1. Heat the article to a bright red heat, rub the surface over with prussiate of potash, and when it has cooled to a dull red, immerse it in water. 2. Treat in a similar manner with powdered borax. 3. Enclose the article in an iron box, together with chips of horn, bone, leather, or hoof, heat all up to a red heat, then immerse in water.

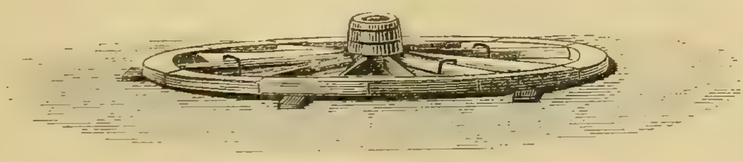


FIG. 300.—CARTWHEEL LAID DOWN FOR TIREING.

Black Varnishes for Iron.—1. Brunswick black applied whilst the iron is hot enough to dry it. 2. Linseed oil varnish, 10 parts; powdered umber, 2 parts; asphalt powder, 2 parts. Grind the powders on a flat stone with a little of the varnish, then mix with the bulk whilst warm. 3. Crush one ounce of brimstone to fine powder, mix this with half-a-pint of turpentine and boil the mixture over a water or steam bath. Paint the iron or steel with this mixture, applied with a soft hair-brush, then heat the article gently until all the turpentine has evaporated. Care must be taken in heating the materials of which varnish is made, to avoid the oils taking fire, as the vapour given off from them whilst being heated, is very inflammable.

Temperature and Shades for Tempering Steel.

Temp. Fahr.	Shade.	Use.
430°	A very pale straw yellow	Tools for cutting hard metal
450°	A shade darker yellow	Tools for cutting softer metal
470°	Another shade darker yellow	Taps and Dies
490°	Still darker yellow	Wood-turning Tools
500°	A brownish yellow	Chipping Chisels
520°	Yellow with slight purple tinge	Hatchets and Axes
530°	A light purple	Saws and Hay-knives
550°	Purple	Stiff Springs
570°	Dark Blue	Mild Springs
590°	Paler Blue	Very mild Springs
610°	Still Paler blue	Too soft for Tools
630°	Pale blue with tinge of green	Too soft for Tools

If the steel is heated higher than this to temper it after it has been hardened by cooling, the effect of the hardening process is destroyed.

Steel coated with a paste of equal parts salt and wheat flour when heated, then heated to a cherry red and plunged into cold soft water, is said to be made very hard and white.

Rust - Preventing Composition.—1. Dissolve $\frac{1}{2}$ oz. camphor in 1 lb. melted lard, and add black lead to make it an iron tint. 2. Melt together 1 part powdered resin with 3 parts lard. Apply with a rag to surfaces to be protected.

To Loosen Rusty Screws and Nuts.—Paint the stubborn screw or nut with any mineral oil, such as paraffin or petroleum, or with any oily volatile liquid

such as turpentine or naphtha. Allow this to soak well in before applying mechanical force. If still stubborn, heat up, and, if possible, fire the oil. A little gentle hammering on top or sides will then loosen the nut or screw, and the spanner or screw-driver will do the rest.

I must here take leave of my readers for the present, and thus close this series of papers. My aim throughout has been to aid my brother amateurs in doing a few jobs of Smithing and Forging. I have not pretended to teach them the whole art in all its branches, nor have I written all that could have been said on those touched upon by me in the preceding pages. More might have been written on the subject by me, and much more by a skilled smith. I shall be pleased to answer any questions relating to "Smithing and Forging," that may be addressed to me in the columns devoted to "Amateurs in Council."

MODEL ENGINE-MAKING.

BY JOHN POCOCK.

VIII.—ECCENTRIC AND STRAP—BED PLATE—GUIDE BARS—CRANK SHAFT—CRANK-BEARING.

WE may now turn our attention to the eccentric and its strap. The former must be chucked by the tenon which should *always* be cast upon this piece; and the edge is to be turned down smooth and a groove $\frac{3}{32}$ of an inch wide, and $\frac{6}{32}$ of an inch deep turned in it. While still in the lathe, the true centre of the eccentric should be marked, and the chucking tenon may then be cut off.

A moment's reflection will make it obvious that when the slide-valve is in action, the port in it must cover the opening of the exhaust port in the cylinder face during the whole of each stroke, while, during each half stroke one or other of the steam ports must also open into the valve port, the two steam ports each in turn becoming an exhaust-way, so that it will be seen that the whole stroke made by the slide valve should be about half the distance from the outer edge of one steam port to the outer edge of the other steam port.

Returning now to the eccentric: A distance equal to half the travel of the valve must be marked off from the centre of the eccentric, and as nearly as possible in the centre of the boss cast on the eccentric; this mark must be centre-punched, and a hole drilled through it of any convenient size, not, of course, exceeding the diameter of the shaft upon which the eccentric is ultimately to be mounted. The piece can now be mounted on a temporary shaft and the boss neatly turned up.

The strap of the eccentric should now be either filed up smooth, or it may be turned up in the lathe, being mounted for the latter purpose upon a wooden mandrel; in either case, it must be finished to just the thickness that will make it a good fit in the groove of the eccentric. The band is also to be bored out the same diameter as the eccentric, the diameter of the latter, being of course callipered at the bottom of the groove. The outside edge of the band must be smoothed off with the file, and $\frac{1}{16}$ inch holes bored in the two projections or lugs. The band is now to be sawn in two, as shown in Fig. 68, and the holes will now be divided, when those in the lower half should be tapped for screws, and those in the upper half slightly enlarged to allow the screws to pass through.

The finished eccentric with its band tted is shown in Fig. 69.

If the bed-plate has not been purchased it may now be cut out; a convenient size will be found to be $10\frac{3}{4}$ inches long and $3\frac{5}{8}$ inches broad. Half an inch from one end a rectangular hole $1\frac{1}{2}$ by $1\frac{1}{4}$ inch must be cut out as shown in Fig. 33, in order to allow the crank to revolve. As to the thickness of the bed-plate the metal used should be $\frac{1}{8}$ or $\frac{5}{32}$ of an inch thick.

The guide-bars must be made smooth by means of the file and scraper.

The crank-shaft must be placed between centres with a piece of wood in the gap and turned down to $\frac{1}{4}$ inch diameter, the proper proportion being ·33 of the diameter of cylinder. The throw of the crank will of course be half the stroke of the piston.

In order to turn the crank-bearing, let the crank be mounted between two long centres in the lathe as shown in Fig. 70, and the spindle turned down to $\frac{5}{16}$ of an inch diameter, which gives about the correct proportion of ·23 of diameter of cylinder. The flat part of the crank must next be finished with the file.

Before proceeding further, it will be best to make full-size working drawings, from which to fit the several parts of the engine together.

Figs. 71 and 72 are working drawings on a scale of six inches to the foot. It will be seen that the parts are so arranged that the length of the connecting rod is just double the stroke of the piston. The other parts of the drawings consist of the castings which we have already more or less worked up.

Some of my readers having met with difficulty in procuring castings, I have called to see those supplied by Messrs. Lucas and Davies, of 21, *Charles Street, Hatton Garden*, and can recommend these as good, clean, and heavy castings. Moreover, Messrs. Lucas and Davies will allow purchasers of their castings to see finished models made up from similar sets, so that the amateur may see how his engine *ought* to look when finished.

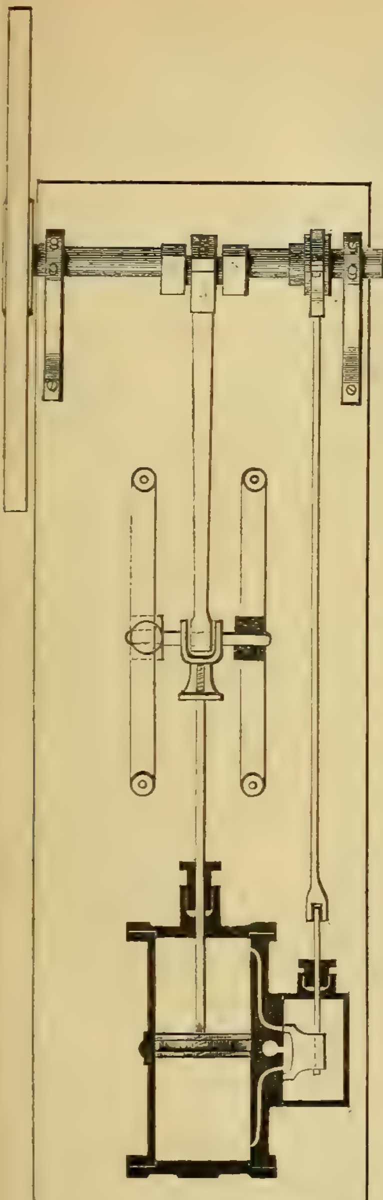


FIG. 72.—WORKING DRAWING OF DOUBLE ACTION HORIZONTAL SLIDE-VALVE ENGINE IN PLAN. SCALE, 6 INCHES TO 1 FOOT.

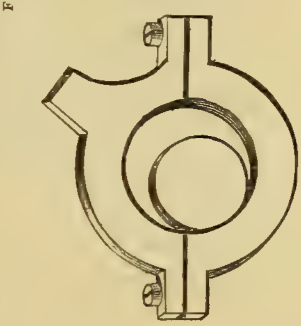


FIG. 69.—ECCENTRIC AND BAND, COMPLETE.

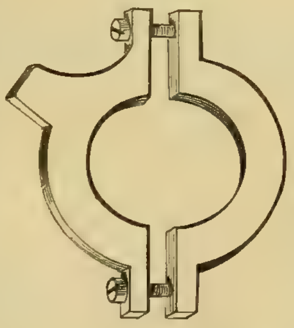


FIG. 68.—ECCENTRIC BAND.

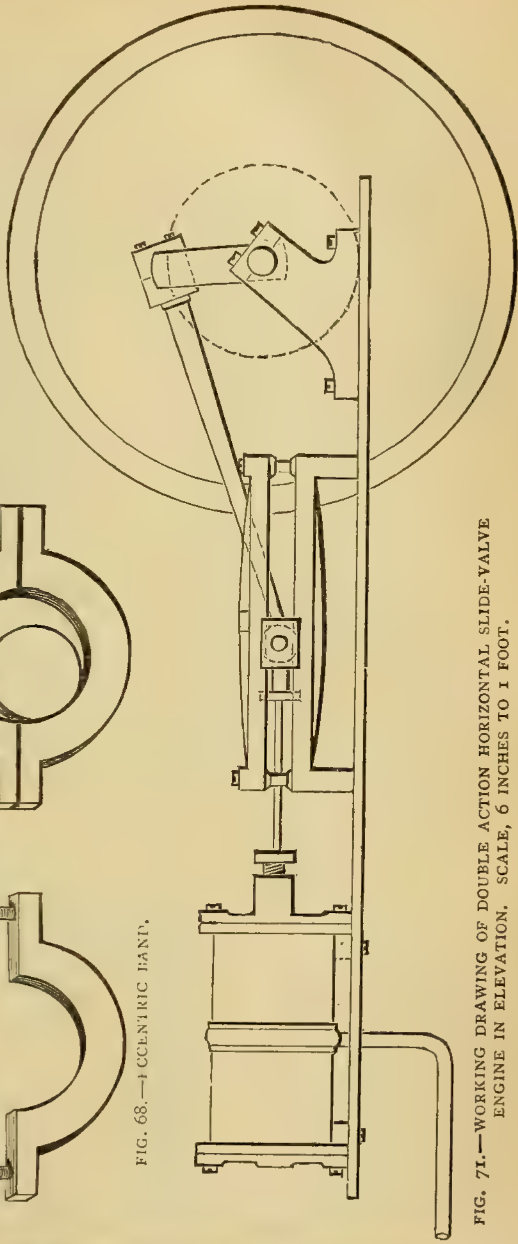


FIG. 71.—WORKING DRAWING OF DOUBLE ACTION HORIZONTAL SLIDE-VALVE ENGINE IN ELEVATION. SCALE, 6 INCHES TO 1 FOOT.

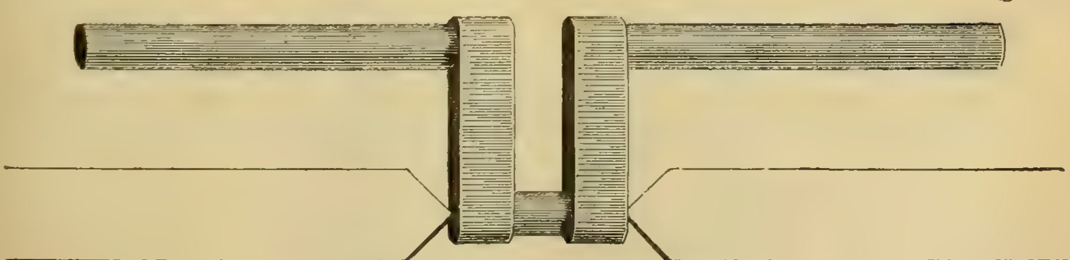


FIG. 70.—CRANK CENTRED FOR TURNING.

NOTES ON NOVELTIES.

By THE EDITOR.

37. La Brillantine. 38. Rochefort's "Jubilee Frame." 39. Skinner & Co.'s Jubilee Design in Fretwork. 40. Self-Grip Holdfast. 41. Patent Brass-Capped Bradawl. 42. Britannia Company's New Lathe. 43. Repoussé Work. 44. Woodhouse and Rawson Electrical Supplies. 45. Zilles' New Fret-Saws and Designs. 46. The Metal Turners' Handy Book. 47. The Albion Carriage Battery.

37. LA BRILLANTINE, manufactured by the sole proprietors, Messrs. J. F. Baumgartner and Co., *London*, but sold by all oil and colourmen, chemists, ironmongers, brushmakers, saddlers, tinworkers, etc., is a metallic powder, rendered impalpable and free from every detrimental ingredient by elutriation, and said to be the best, cheapest, and most effective powder that can be had for cleaning, polishing, and preserving all metal and glass articles of any and every kind, imparting to them a brilliancy which is marvellous in its appearance and astonishing in its duration. The powder itself, which is red in colour, and very heavy, which it would be naturally on account of its metallic origin, is used in the following manner:—"Mix 1 part of powder in 3 of water or oil, and with a piece of rag apply it to the object to be cleansed (for chased or ornamental work use a brush), and after rubbing it sufficiently, finish it off with a thoroughly dry clean rag (or brush), and a most brilliant durable polish is produced." In cleaning plate the powder should be mixed with more oil or water than stated above, in order to render the mixture more diluted. The powder is said to be used for cleaning arms, accoutrements, helmets, etc., by the principal cavalry regiments and by the Metropolitan and volunteer fire brigades. A trial of the powder "La Brillantine," made by myself, on brass and steel, was attended with the most satisfactory results. I applied it as directed above, and after using dry clean rag as a polishing medium, I finished off by rubbing the surface with the palm of my hand, which had the effect of heightening the brilliancy of the polished metal still more. There is nothing better than the palm of the hand for imparting a finish in these cases. It is sold in packets at 1d. and in boxes at 6d. and 1s. To ensure the powder being genuine, take care that the labels bear the signature *Jos. Baumgartner Fils*, and refuse any box or packet which does not bear the registered label and signature.

38. *Rochefort's "Jubilee Frame."*—Mr. Gus. Rochefort, Wholesale Picture and Show Card Frame and Moulding Factory, 29, *Basinghall Street, London, E.C.*, sends a specimen of a coloured lithograph of Her Majesty suitably mounted, in a handsome gilt frame, about which he writes as follows:—"As to Englishmen, this is an eventful year: being the fiftieth or jubilee year of the reign of our illustrious Sovereign Lady Queen Victoria, I propose to offer to all readers of Amateur Work, as a souvenir of the time, a handsome tinted portrait, mounted and framed as per sample. intend to call this the "Jubilee Frame," and merely charge for the preliminaries of correspondence, packing, and man's time to make, which I have reckoned at 1s. 6d. as a minimum, and for this small amount, I undertake to deliver to anyone applying at my warehouse, 29, *Basinghall Street, London, E.C.*, and mentioning the name of the Magazine, one of the above-named Jubilee Frames. As the Post Office have undertaken to convey the frame, per parcel post, to any address, for 6d., I shall be pleased to pack it very carefully in board and paper, and to send the same, duly addressed and stamped for the sum of 2s." To this announcement, I may add that the frame itself in outside measurement, is 12½ inches by 11 inches, and that the moulding is 2¼ inches wide. On the front of the frame, at the top, is fixed a representation of the royal arms and supporters stamped and embossed, and gilt. The portrait of Her Majesty in colours, and very delicately executed, showing the Queen robed and crowned, and wearing the ribbon of the Garter, and various orders, is placed in a gilt mount, outside and over which is another mount of greenish grey tint, so cut as to exhibit the gilt mount below in the form of a shield. The frame and portrait are worth more than is asked for them, which is a nominal amount to cover the incidentals mentioned by Mr. Rochefort above. The moulding of which the frame is made is bold and handsome, and worthy the attention of amateurs who frame their own pictures.

39. *Messrs. J. H. Skinner and Co.'s Jubilee Design in Fretwork.* — Even fretworkers ought to have something special for the Jubilee Year of Her Majesty Queen Victoria (whom may God long keep on the throne of the United Kingdom of Great Britain—*and Ireland*), and with this view Messrs. J. H. Skinner and Co., *East Dereham, Norfolk*, have prepared an "Emblematical Design in Celebration of Her Most Gracious Majesty's Jubilee," arranged for cutting in eight sections, the design being complete in five sheets, which are well printed in a nice brown tint on good paper, and sold at 2s. 6d. Every information is given on the sheets with regard to the wood to be used, the mirrors and other fittings to be applied, and the proper modes of fastening the various sections together. The entire design forms an imposing cabinet, combined with hanging shelves for china and bric-a-brac. In the very centre, above the principal shelf, is a figure of Britannia standing erect between the British lion and the Indian tiger, which are flanked, the former by the ostrich of South Africa, and the latter by a trophy of weapons, etc., used by savage races. Above the lion and tiger are two small shelves, backed by a soldier and sailor with emblematic surroundings, and above Britannia is the legend, "1837—V. R.—1887," with the lion and unicorn, and a lion on a shield, for which a painting of the actual arms might be substituted. Below the principal shelf are two smaller shelves, backed by mirrors, and flanking a central cabinet, the front and sides of which consist of panels in fretwork exhibiting the rose, shamrock, and thistle, with the words, "God bless our Queen, long may she reign!" The design is finished below with a group of foliage and animals, showing the kangaroo of Australia, and sheep of New Zealand. The whole, as a piece of work, is ambitious in its scope, and cannot fail to look well if executed in the manner pointed out by Messrs. Skinner and Co. in the ample instructions for procedure given on the sheets.

40. *Self-Grip Holdfast.* — Messrs. R. Melhuish and Sons, 85 and 87, *Fetter Lane, London, E.C.*, send me a specimen of a new appliance, made of galvanised iron, for receiving and holding in place a stretched line, such as a clothes line, called the Self-Grip Holdfast. The nature of the appliance may be gathered from the accompanying illustration. The plate is pierced with three holes, by means of which it can be attached to any surface of wood, and notably to the top of a clothes-post, or rather one side of the post, a little below the top. The free end of the clothes line is passed over the fork at the top of the piece that works in sockets formed in the plate, and is brought down under the transverse bar at the bottom of this piece. The greater the weight and strain on the clothes line, the greater is the pressure and grip exerted on the pendant end by the bar at the end of the lever. Yet there is no difficulty whatever in tightening the line as it slackens, by the dryness of the atmosphere, etc., for on pulling the end below the lever, the cord may be strained to the utmost, and is instantly gripped and held in that position by the T-shaped end of the lever, when the line is released. These handy Self-Grip Holdfasts, which enable those who adopt them to put up a clothes line and take it down in a quarter of the time taken up under the old method, are supplied at 1s. each. No one who indulges in the luxury of washing at home should be without them.

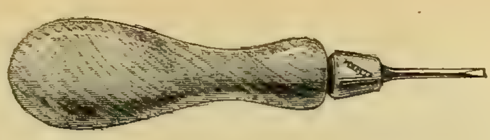


FIG. 2.—PATENT BRASS-CAPPED BRADAWL.

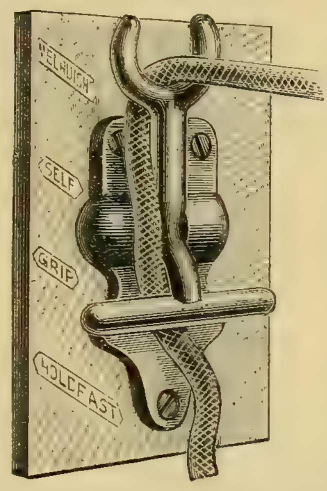


FIG. 3.—SELF-GRIP HOLDFAST.

41. *Patent Brass-Capped Bradawl.*—Messrs. R. Melhuish and Sons also send a very serviceable modification of the ordinary bradawl, which I can confidently recommend to the notice of all mechanics, whether professional or amateur. The old form of bradawl, which was fixed into the handle by driving the tang into the wood up to the hilt, as one may say was inconvenient, insomuch that handle and awl were sometimes given to part company, the awl being left in the wood that was being bored, and the handle only remaining in the hand of the operator, thereby boring him much more effectually than the wood. There is no chance of severance of continuity, however, in the "Patent Brass-Capped Bradawl"; for, as may be seen from the illustration, the awl is securely retained in the handle by a brass cap, which apparently screws on to the upper extremity of the handle. I say apparently, because at this present moment I have not time to take one apart in order to verify the fact or otherwise. But be this as it may, this Patent Brass-Capped Bradawl is a good and safe tool to use, and is well worth its extra cost over that of the old form, when its advantages are borne in mind. These bradawls are supplied, carriage free, at 3s. per dozen, assorted.

42. *Britannia Company's New Lathe.* —The Britannia Company, *Colchester*, have recently added to their already very large stock of lathes and lathe appliances a new lathe, which is figured in the accompanying illustration. Apparently no special and distinctive name has been given to it as yet; and this is a pity, because when there are so many lathes in existence, and the Britannia Company themselves are constantly producing something novel in this way, it is rather vague to speak of the latest made as the "New Lathe," especially as in a few months—perhaps in a few weeks' time—it will have lost its claim to the title by the introduction of another. As may be seen from the engraving, it is a solidly-made machine, of handsome appearance, taking up but little space, and well calculated for small work. The bed is 2 feet 6 inches in length, fitted with hard steel mandrel and collars. With regard to capacity, it is a 3-inch centre, and the mountings are of gun-metal. It has a three-speed pulley and a well-made and heavy fly-wheel fitted on a stout axle. It is no flimsily-constructed, rickety

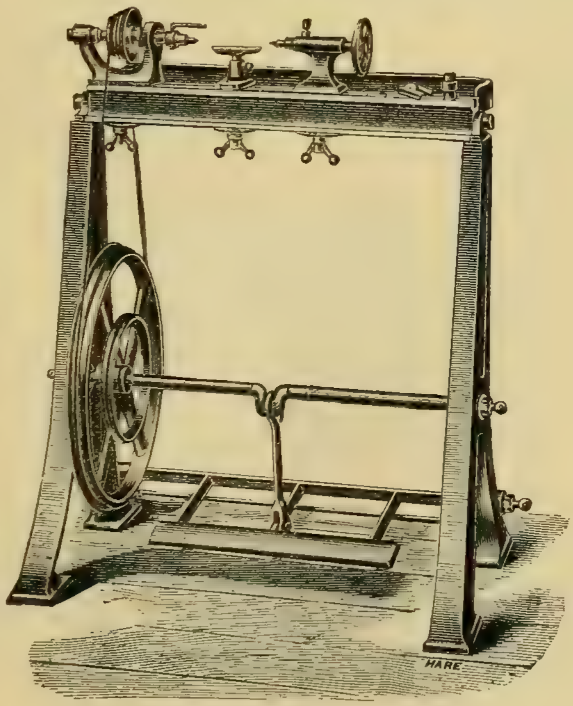


FIG. 1.—BRITANNIA COMPANY'S NEW LATHE.

machine, and, although small, it is well worth the price asked for it, viz., £6 10s., and in this light it may be said to be just the thing for amateurs who want a really good lathe at a fair price. It is also well adapted for dentists, clockmakers, etc. If desired, a special compound slide-rest can be supplied with it, at an increased figure. Amateurs wishing to examine this lathe, or any other machine made by the Britannia Company, can do so by calling at the Company's Show Rooms, No. 99, *Fenchurch Street, London, E.C.*

43. *Repoussé Work.*—A notable example of the value of Repoussé Work as a means of executing enduring memorials of, I may say, persons, places, and things, has recently been afforded by Mr. Frederick Smith, the head of the staff of brass-workers employed by Messrs. Wippell, Brothers, and Row, Ironmongers and Manufacturers, 231 *and* 232, *High Street, Exeter*, in a memorial portrait of the late Earl of Iddesleigh, which has been presented to the Countess of Iddesleigh, and is much prized by her as an indication of the respect and affection with which the late Earl was always regarded by Devonshire working-men, and especially by those of Exeter, the "ever-faithful" city. The likeness of the late Earl is surrounded by a wreath of roses, lilies, pansies, forget-me-nots, and primroses, very tastefully arranged. It gives me much pleasure, being myself a Devonshire man, to call attention to Mr. Smith's memorial of a "Worthy of Devon," whose blameless life and spotless career form "a monument more enduring than brass." And, further, I am glad to do it, because Mr. Smith, who is a reader of "Ours," and an expert in Repoussé work, offers to render assistance and advice to any amateur who may seek his aid. Any reader who wishes to possess a photograph of the memorial may obtain one post-free by sending 1s. 3d. to Mr. Smith at the address given above.

44. *Woodhouse and Rawson Electrical Supplies.*—The new edition of the Catalogue published by The Woodhouse and Rawson Electric Supply Co., of Great Britain, Limited, is a most desirable work of reference for the Amateur's bookshelves, and will be prized by all amateur electricians. The greater portion of the book is devoted to a description of their well-known electrical supplies, such as Incandescent Lamps, Switches, Cut Outs, Instruments, Jensen Electric Bells, etc., etc. (the particulars of their Upward Battery for Domestic Lighting, Electric Gas Lighting Supplies, and the Welsbach Gas Burner are published in separate lists). As a price list of all the leading articles used in the electrical industries, it will, I am sure, be found exceedingly useful—the part referring to sundries making it a work which should be in the hands of every electrical engineer.

The Company are taking up the useful field of keeping in stock, and supplying every article used in connection with electricity, thus opening up to electrical engineers exceptional opportunities for obtaining the numerous odds and ends connected with their craft with the least possible delay. I am sure that the possession of this Catalogue would put amateur electricians in possession of many facts respecting materials, machinery, processes, and electrical plant of every description, about which some information and guidance is often wanted in a hurry. I said, a short time ago, that I was unable to give the address of this Company, but I learn from their Catalogue that their head offices and sample rooms are at 11, *Queen Victoria Street, London, E.C.* Readers, please note this address, and further mark that the price of the Catalogue, post free, is 1s.

45. *Zilles' New Fret-Saws and Designs.*—Mr. Henry Zilles, 9, *South Street, Finsbury, London, E.C.*, sends me specimens of his New Large Size Fret-Saws, which will be welcomed by all who wish to cut with ease and speed wood of greater thickness and patterns that are more simple than the wood and designs generally used for ordinary fret-work. Their sizes and prices, *post free*, are as follows ;—

in. broad.	5 inches long.					6½ inches long.				
$\frac{1}{48}$	3s. 9d.	per gross	or	4d.	per doz.	4s. 9d.	per gross	or	5d.	per doz
$\frac{1}{24}$	4s. 0d.	,,	,,	4½d.	,,	5s. 0d.	,,	,,	4½d.	,,
$\frac{1}{16}$	4s. 6d.	,,	,,	5d.	,,	5s. 6d.	,,	,,	6d.	,,
$\frac{1}{12}$	4s. 9d.	,,	,,	5½d.	,,	6s. 0d.	,,	,,	6½d.	,,
$\frac{1}{10}$	5s. 3d.	,,	,,	6d.	,,	6s. 6d.	,,	,,	7d.	,,
$\frac{1}{8}$	5s. 9d.	,,	,,	6½d.	,,	7s. 0d.	,,	,,	7½d.	,,

The above saws correspond with the old numbers, 7, 8, 9, 10, 11, and 12. They are made of the finest *English* steel, of exceeding hardness, and have a rounded back. The teeth are sharp, and cut rapidly, but do not split the wood. They are especially adapted for cutting soft wood, such as deal, lime, etc., and for cutting coarse pieces out of hard wood. Not a month passes but Mr. Zilles makes an addition to his already numerous stock of designs. He now sends me several new patterns for fret-work, inlaid work, and wood carving, in which beauty and utility are admirably combined. First and foremost amongst these is a chess-board in inlaid work (No. 80), the border of which will give anyone who attempts it abundant employment for a considerable time, but with patience and perseverance the result cannot fail to be satisfactory. Among others I may commend attention to No. 647, a tray for bottle and tumblers in wood carving, Nos. 130 and 131, a bird cage, No. 125, a cigar stand, No. 123, a night lamp, all in fretwork ; Nos. 110 and 111, a frog tower with aquarium, in fretwork and carving combined ; and Nos. 93 and 94 a corner cupboard, and particularly Nos. 50 and 51, a flower-table and fountain combined. All being good, the difficulty on my part really lies in selection, and this, I expect, would be the case with many of my readers if they were to proceed to an inspection of these designs *en masse.*

46. *The Metal Turners' Handy Book.*—Messrs. Crosby Lockwood & Co. have issued, price 2s., a second edition of the "Metal Turners' Handy B•ok : a Practical Manual for Workers at the Foot-Lathe, embracing Information on the Tools, Appliances, and Processes employed in Metal Turning," by Mr. Paul N. Hasluck, A.I.M.E., author of "Lathe Work," etc. This work is "The Metal Turners' Hand-Book," in an improved and extended form. It touches on every kind of lathe, and appliances for the lathe, used in metal-turning, and describes, briefly and tersely, but sufficiently, their construction and purpose, and how to use them. Upwards of one hundred illustrations are given to help the reader to a proper comprehension of the text. The chapter on Lathe Motors will be found especially interesting,

although there is not a page in the whole book which will be found devoid of interest to those who possess a lathe on the one hand, and to those who are in quest of a lathe that will exactly suit them and the work they have in view on the other.

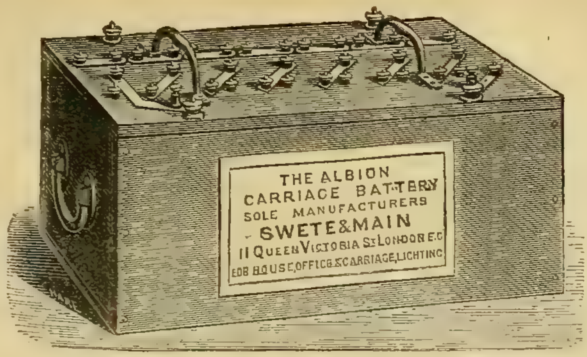


FIG. 4.—ALBION CARRIAGE BATTERY WHEN CLOSED.

47. *The Albion Carriage Battery.*— Messrs. Swete and Main, Electric Light Contractors, 11, *Queen Victoria Street, London, E.C.*, have just produced a new electric lighting appliance for carriages, called the "Albion Carriage Battery," which is described by them as follows:—"It is made in teak or mahogany, but preferably teak, and consists of seven double fluid cells, each fitted with one carbon and two zinc elements. The elements are supported on a teak tray or cover, which, being lined with indiarubber, fits down upon the battery box containing the cells, thereby rendering the whole secure against any spilling of the liquids. The box has a pair of handles affixed for the purpose of carrying about with ease. The whole weighs, when charged with liquids, about 40lbs., and measures 17 inches by 8 inches by 10 inches, and is designed with a view of being easily placed beneath the coachman's seat. This battery will light three five-candle power lamps for a period of twelve hours, at a cost of 2s. The lamps need not be used for this length of time, but as required, *i.e.*, one hour one day, six hours the next, and so on, if the elements are lifted out of the solution when the carriage is in its coach house. The trouble attending this battery is exceedingly small, everything being made so simply that it is within the comprehension of every coachman or stable-boy. Suppose, for instance, the carriage is wanted at night, when, naturally, the ordinary wax lights would be required, all the stable-boy or coachman has to do is to fill up each outside cell with the clear solution (which is 1 of sulphuric acid in 16 parts water) to within two inches of the top, and half fill the porous pots or inner cells with the red solution. Gently place the elements in the cells (the zinc plates fit into the wood cells, the carbon plates into the porous pots), so that the marked sides coincide, and screw down the fixing screws; this will render the whole watertight, and no danger from liquids need be feared. The battery is then placed under the coachman's seat and the conducting wires attached to the terminals shown; it does not matter which is attached to which. This will immediately light the three lights. Should the light not be required inside the carriage, all that is necessary is that the occupant move the switch to "off," and the inside light alone will go out. The solution and parts can be had at any time from the makers. The cost of fitting up a carriage complete with battery, three five-candle power lamps, and one switch, including labour in wiring and fixing same, is £8. The annexed illustrations show the battery open and closed, and how it is utilised in lighting a carriage. It appears to be an easy, simple, and desirable mode of effecting the purpose for which the battery and its appliances are intended,

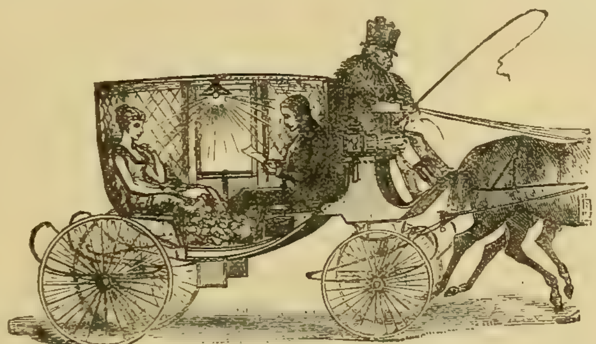


FIG. 6.—CARRIAGE LIGHTED WITHIN AND WITHOUT WITH BATTERY.

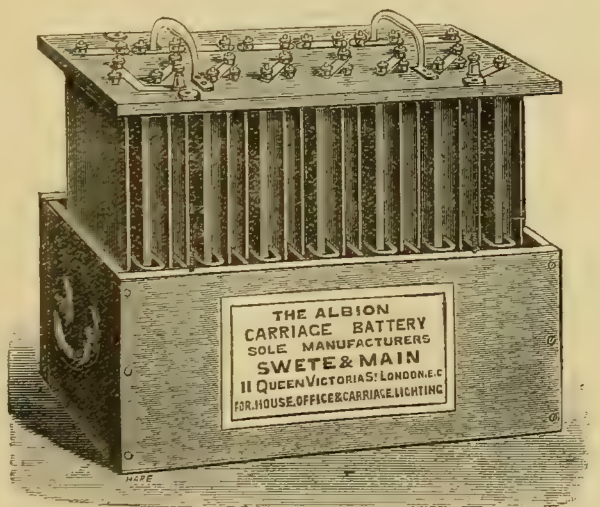


FIG. 5.—BATTERY WHEN OPEN EXHIBITING CONSTRUCTION.

AMATEURS IN COUNCIL.

For "Instructions to Contributors and Correspondents," see page 44 of this Volume, or Part 60, page 44.

Fretwork, Wood Carving, Etc.

*** The following are the names and addresses of correspondents willing to entertain proposals to cut fretwork, etc. :—

Walter B. Heath, *Wynard's Cottage, Magdalen Street, Exeter.*

Joseph Warwick, 17, *Railway Street, Percy Main, near North Shields, Northumberland.*

Dry Plate Photography.

*** I regret to say that Mr. C. C. Vevers has met with an accident which for some weeks has disabled his right arm, hence the break in the continuity of his papers.

Bee-Hives and Bee-Furniture.—A Correction.

Walter J. Stanford writes: — "Mr. S. J. Baldwin has asked me to state that his prices for sections are as follows: 1st quality, 25s. per 1000, 14s. per 500; 2nd quality, 21s. per 1000. In Part 65 I quoted them at 28s. per 1000."

Violin Case.

Ruddygore.—A paper on this subject is in hand, and will appear as soon as room can be found for it. "First come, first served," is my rule, as far as I can carry it out.

Rubber Tyres.

T. E. B. (*Eastbourne*).—The method of fixing rubber tyres to wheels of bicycles, tricycles, perambulators, etc., is described in this Magazine, in Chapter IV. of "Velocipedes: their Construction and Use," Vol. II., page 168, otherwise Part 15, price 6d. In this the iron necessary for searing or scorching the rubber tyre is illustrated.

Corners for Picture Frames.

H. K. (*Tadcaster*).—I may say there are two sorts of corners: first are "compo," which is the trade name, and is made of glue, rosin, pitch, and whiting, boiled together and made to the substance of glaziers' putty. When sufficiently cool to handle is moulded in boxwood moulds, ready cut to pattern and design, etc., and then usually put on frames while soft, or if kept too long they are softened. For example, we will take that which is most handy with the amateur—the glue pot. Let the well or outer pot have sufficient water in, and when boiling take out the inner pot containing the glue, and place a piece of rag—the corner of a dirty apron will do—over the steaming well, and place your compo corners on the warm steam back downwards, or, to be more plain, the ornament upwards. Care must be taken that they do not get too soft and pappy, or you will spoil them. When you find them soft enough to be pliable, or like india-rubber, place them on your frame and press them into the sections of the frame. A little glue will help to make them hold better. Sometimes we fill the sections of frames with compo under the corner, to back it up and make it more bold. For cheap frames there are nice metal corners made and fixed with brass rivets or thin brass screws, which, when fixed, look as if they were moulded on the frames. I often use them, and my friends can't detect them when properly fixed. These latter corners are of the best brass, moulded and lacquered as near gold as possible. The former corners mentioned are only for frames before gilding, as, no doubt, dear reader, you are aware, if you attempted to put these corners on after gilding, the gold would come off and also spoil the frame. I may add that Mr. Gus Rochefort, 29, *Basinghall Street, London, E.C.*, supplies the brass corners, with pins ready for fixing, at 4d. per set, to suit ½ to ¾ wide frames; and 6d. per set ⅞ to ⅞ wide frames; and 1s. 3d. per set 2½ inch, 3 inch, to 3½ inches wide; and compo corners from 6d. per set to 2s. 6d., according to width.—An Old Frame Maker.

Overhead Motion.

Grooved Barrel.—As you seem to work in metal, you might get "The Metal Turners' Handybook," by P. N. Hasluck (Crosby Lockwood & Co.); it contains three or four good illustrations of different kinds of overheads, and it only costs 2s. Hasluck's "Lathe Work" is more complete, and costs 5s. If Grooved Barrel cannot yet understand how the overhead is used, I think the only way would be to see one in use. An overhead may be a very simple thing; two pairs of pulleys, hanging from the ceiling, can be made to serve and convey the motion band from the flywheel below to the driller held in the slide-rest; they only require to be hung so as to stretch the band tight, and lead it straight off the flywheel and on to the driller pulley and back to the flywheel again, and do this still even when the driller is moved by the slide-rest. Buck makes an overhead for £3; this is as low as you could well go, and it acts very well. —F. A. M.

Smithing and Forging.

H. M. (*Honfleur*).—I note your remarks about "Smithing and Forging." Locksmiths' work is a branch of smithing which will be taken up when opportunity offers. Mr. Edwinson cannot do everything at once, nor would it be desirable for him to do so, even if it were possible, for, please mark, if everything were done to-day there would be nothing to do to-morrow. There are many who are benefited by the articles on "Smithing and Forging," although it is not every amateur who will care to do smith's work, and, I need hardly remind you, that one man will relish bread and cheese and the savoury, but strong smelling, onion, cut with his hack knife; while another will turn with horror from the viands themselves and the implement with which they are carved. And as with diet indeed, so is it with work.

Amateur Mechanics' Associations.

A. D. (*Stratford, Essex*) writes:—"The suggestion of A. F. C. is indeed a good one. But who will undertake the necessary labour in starting the same? I have a suggestion to make, viz., that those of your readers who would be willing to undertake a share in carrying the idea out, and those who would be willing to become members of the same, should send on to me their names, etc., also any suggestions that might occur to them; a sort of conference could then be held, rules, etc., framed, and the matter put upon a fair footing. Already a large number of amateurs have expressed their desire to join such a society when started." [Societies formed on this principle, being local, must be under local management. Thus it would be useless for any amateurs but those who are residing in or near *Stratford, Essex*, to send their names to A. D., who lives in Stratford. Amateurs wishing to get up such societies should make known their views and intentions per advertisement in the local paper of the district in which they reside. Letters forwarded for A. D., must be enclosed to me in envelope, stamped and sealed down, and lettered A. D. in corner.—Ed.]

How I Furnished My House.

P. E. M. (*Camberwell*).—The thicknesses of wood given with these designs mean what is ordinarily understood by "½ inch board," "¾ inch board," etc., that is, as received from the yard. The trifling reductions caused by planing is scarcely appreciable in drawings made to the scales employed. The question of finish, *i.e.*, whether the work shall be ebonised, stained, or simply varnished, has been left to the individual taste of the worker, and such abundant directions for performing all these operations in the best manner, have already been given in Amateur Work, that to repeat them in connection with the present series of articles seemed superfluous.—M. M.

Marbling Edges of Books.

H. C.—The process of book-edge marbling is a very dirty one, and requires certainly a room to itself. A certain amount of practice is also required to do it at all successfully. The tools used are—very finely ground colours, brushes for each colour, a large number of small pots, troughs, gum. The cost for a small outfit might be managed for say £4, but this would entirely depend how one went to work.—Author of "Bookbinding for Amateurs."

Plane Iron.

Grooved Barrel.—You have evidently got a bad piece of steel, and no amount of tempering will make it better. The Stanley plane is not built strong enough for hard tough wood. The wood workers in the United States do not work such hard woods as in the old countries. You will observe all American planes are of light construction. Now what you want is the old-fashioned iron plane, walnut fitted, the same as used by all our best cabinetmakers and hardwood joiners.—R. M

Vertical Boiler.

A. Sheed.—Instructions will be given shortly on the making of small boilers, but for your comparatively large requirements I would recommend you to purchase. Your engine will develope about 3 or 4 horse-power, and with that you might drive a small "Gramme" machine, representing 700 or 800 candles. The price of a "ready-made" boiler of the type mentioned would be about £30 or so, with all mountings complete.—Olla Podrida.

A Message from St. Helena.

H. W. B. B. (*St. Helena*) writes:—"If a poll were taken of the subscribers to AMATEUR WORK I imagine a large percentage would appear as occupying their leisure with the lighter branches of ornamental carpentry, to wit, wood carving, turning, and fretsawing. And the reason is not far to seek, for, given a turn for wood-working, it is only natural amateurs should endeavour to produce something at once useful in its outcome, and a means of ornamenting their home. For the amateur cannot always be exercising his skill with saw and hammer, by the construction of outside sheds, fowl-houses, etc., and as most people who start a workshop already possess the needful furniture of the more solid character (although an earlier introduction to Mark Mallet might have altered matters there), it follows that ornamental additions to the house, and the construction of workshops and other appliances, are the subjects under discussion by most woodworking amateurs. As one of this large class (spreading daily, too, through the efforts of 'Ours'), I should, with your permission, sir, like to say a few words on certain appliances which have lately come under my notice. I may as well say at once (as my signature will attest) that I have no interest whatever in any of the firms named, and write merely to assist beginners in choice of suitable means to pursue a charming hobby. And, first, as regards fret-sawing. Twenty years ago, when I first took up this beautiful art, a complete fever for the work swept over England, but it died out to a great extent for two reasons; one was the fact that the designs available consisted mostly of useless nick-nacs, fragile, and a poor result for the labour expended; the other was the somewhat arduous nature of the work as entailed by the use of the hand-saw and inferior blades. Since that time, by the introduction of cheap machines, artistic designs, and superior materials (mainly, I confess, due to our Yankee cousins), a marvellous impetus has been given to the work, fostered by the discovery by amateurs, that inlaying, overlaying, metal and ivory cutting, were easily carved out by the obedient saw, in addition to the plain fretwork. As regards the machines in the market, I may say I have owned or tried every make advertised, cheap and expensive, and so defective have I found them that I had, until recently, come to the conclusion that I would revert to the old hand-frame. Those made with moving arms are so inaccurate that fine work cannot be done with them, and, unless combined with the lathe, as suggested by me in a previous article, lack power to cut any considerable thickness. The machines made on the slide principle I found either much too light, or faulty in mechanical principle, such, for instance, as working the saw from the top bar, with a spring underneath for the lower end of saw. Happening to see an advertisement of the Britannia Company in your Magazine of their new No. 7 Fretsaw, I sent for one, and at last I possess a tool which answers every requirement of the fret-sawyer. It is a thoroughly workmanlike tool, beautifully made, and easy to work. It has the great advantage of a 3-speed lathe fly-wheel, giving varied power for different materials, and the action of the saw is true to a hair, powerful, and strained by a spiral spring. The large wooden table is a great boon, and so is the movable piece to get at the lower arm. Its price (50s.) is wonderfully low for a machine on the slide principle; and in construction far excels any other for solidity. I am speaking, of course, of foot-power machines only. I strongly advise its adoption by all taking up the art. But however good the machine, with inferior blades, high-class work cannot be done, and here an immense improvement has been introduced in the round-backed 'Champion' saws. I obtain mine from Mr. Zilles, and not only do they simply 'whistle' through the work, but that sharpness at angles and corners, so difficult with the old sort, is easily attained by them. For inlaying they are a luxury. Mr. Zilles' designs are so well known that a passing tribute only is needed to their artistic beauty and accuracy of measurement. As regards materials, there is a wide field now for selection, and in choice of woods the amateur will have no difficulty in obtaining kinds suitable for all designs. But I have often thought the price of wood much higher than need be, and for us dwellers in the Colonies, a heavy item. Will not some enterprising firm make up cases of boards (say 3 feet long) for export, put on board ship at a price which will make it worth while to have them out, instead of falling back on badly planed local products, or old cigar boxes? I recommend all fret-sawyers to get a specimen of Mr. Zilles' plated zinc sheets. By its means nearly all the necessary adjuncts, such as hinges, latches, corners, etc., can be made, and for inlaying with ebonised wood nothing could be better. As a handbook to the art, procure Williams' 'Fret-sawing for Pleasure and Profit' (Churchill and Co., *Cross Street, Finsbury, E.C.*) It deals lucidly with all branches of the work. For those who combine wood carving with fretwork, or practise it alone, the appliances needed are few, and Mr. Melhuish, of *Fetter Lane, London*, supplies all necessary tools, of excellent quality and very cheap.

"Now for our turning friends. Many a one has felt, no doubt, like the writer, a pang of regret when looking at his pretty lathe, that so little work was got out of it in connection with light carpentry. The fact is there are very few designs published combining turning with fret-sawing or carving. Mr. Zilles has some, and AMATEUR WORK has given us two or three. We want more. The use of the lathe is a pleasant change from saw and polish, and there is a much more cabinet-maker's look about articles partly turned, than plain, flat surfaces, as produced by fretwork. Therefore, designers, give us more, and AMATEUR WORK, please note! To all owners of a lathe, I say add a circular saw. They can be bought with spindle complete, very cheap, and will do all ripping, etc., in light wood work. I have seen several methods of fixing the saw-table recommended, but all entail unscrewing same from lathe-bed. My plan is this: I screw to the wooden table of my lathe a light square iron frame, and to the top of this I hinge the wood sawing table, which consequently falls over the saw when in place, and throws back out of the way when not in use. It is thus ready for work in a moment, and, when over the saw, is supported by the ordinary hand-rest, which gives the necessary rise and fall. Those who wish to drill their fretwork in the lathe can do so by turning the mandrel headstock round. This answers well, too, for large circular plates, etc., which the sweep of centres will not take, by fixing up a temporary rest. Many amateurs have great difficulty in finishing off and polishing their work, and resort, I fear, to varnish to save elbow grease. Now most woods are quite spoilt by varnishing, unless done to perfection, as with carriage work; so persevere with the French polish, and the results will well repay you. I have seen it stated that very soft woods only should be sized before polishing. My experience is that *all* woods are polished as easily again by first sizing, then slightly glass-papering, and finally polishing. I use fish glue, diluted with hot water, and it sets very quickly. In putting work together, assist the glue by dowelling. This I do with fine wire brads; hammer them in to one piece of the wood half way, cut off the head, and file to sharp point, then hammer the other piece of work in position, glued first, of course."—[It is with the utmost pleasure that I publish your letter. I note all the points you urge, and will do all I can to meet your wishes.—ED.]

Fan for Fret-saw.

M. C. D. (*Hull*).—The fan must take the dust in at the sides by means of pipes leading from top and bottom of work. The fan should be about 4 inches in diameter, and the blades curved in the opposite direction to that shown by you on your rough sketch. The blades or vanes should be about 1 or 1¼ inches square, and the fan set ½ inch out of the centre in a direction at right angles to the delivery nozzle or pipe. As to speed, it should be driven as fast as possible, not less than about 1,000 revolutions per minute, and to facilitate this, the fan must be very carefully balanced so that no arm or vane is heavier than another. Speaking for myself, I would prefer the ordinary "puff" blower for clearing away the sawdust, although I will own that it is rather "dry" work. In a back number of AMATEUR WORK you will find illustrations of a fret-sawing machine, designed by me, which is provided with bellows. I have proved the arrangement to answer very well, and it certainly takes less power than would be required for driving a fan.—OLLA PODRIDA.

Decoration of Large Room.

N. NOTTOC.—You ask for suggestions on the method to be followed in decorating a large room recently added to your house, and intended to be used for dances, concerts, and social gatherings, after the Moorish or Anglo-Japanese style, and under certain conditions. The chief difficulty in advising is the question of cost,

particularly if the most distinctive feature of Moorish (or its neighbour, Egyptian) decoration is within your limit—the Caircue lattice work—as it is now commonly called. In AMATEUR WORK, Vol. II., page 559, there is an article on "Oriental Lattice Work," copiously illustrated, which will be of great service to you; if you do not already know it, look it up by all means. My knowledge of "Moorish" art is confined to text-books and the Eastern interiors and house fronts, somewhere at South Kensington, then in the Indian section, and now I know not where, some of them I fear in gas, as they were burnt in the fire during the Health Exhibition. So far as all these examples go, colour, rich and varied, gaudy at times, but always colour, is everywhere, and I fear a *white* room must needs adopt a classical style, rather than the elaborated chromatic Arabesque gorgeousness, so dear to Eastern art. A simple arch of wood cut in the cusped horseshoe heading which marks the Alhambra (of Granada, not Leicester Square), would be enough, if bright colours were added, but would look a poor sham in white or soft modern tints. The Liberty printed fabrics offer many textures, that pasted directly on to the wall (if dust is specially feared), or hung stretched in panels, would help the decoration, while the grating of the hot-air chamber might be painted almost an exact imitation of the Cairo lattice window shutters. If Anglo-Japanese is chosen, the favourite pink hawthorn, painted after true Japanese designs, such as their native picture-books or fans supply, would keep the (Anglo)-Japanese feeling, and the insertion of some Japanese lattice wood-work, generally geometrical designs in angular devices, might be adopted to screen the glass above the doors, and used partially in the same way for the windows. The frieze might have "flying storks" stencilled in a quiet blue, on the white ground, and all the seats be cushioned in Liberty Japanese chintzes, while if the cost was not a drawback, Japanese leather-paper, particularly the new "carved ivory" designs of this year, would decorate the walls. It is almost impossible, without special diagrams, to do more than suggest the treatment in either case. Thanks to the beautifully exact plan sent the room is easily realized, but to convey in return the decoration is not easy in a few lines of letterpress, without sketches or colours.—J. W. G.-W.

Circular Saw Bench.

OLD SAW (*Oldbury*).—Your engine will drive the saw efficiently without any alteration of the bench, other than the removal of the flywheel and treadle and the substitution of a countershaft in place of the crankshaft. I would arrange it in this manner: Remove the crankshaft, and fit a straight shaft in its place carrying two pulleys, one about half the diameter of the original flywheel, and similar in form of rim, for driving saw, and the other about 6 or 7 inches in diameter, driven from large pulley on engine shaft or from flywheel of engine, if suitable. Any surplus power which might be left in the engine could be utilized by means of a larger saw, which would be a decided advantage. In any case it is desirable to have a margin of power in a prime mover. It is a great mistake to cut things fine in that direction.—OLLA PODRIDA.

Drawing to Scale.

DITHE (*St. Petersburgh*) writes:—"In this Magazine there have been, from time to time, discussions about making drawings to scale, and altering drawings from one scale to another. The readers have been recommended to do this with the help of suitable paper ruled off in squares. The great drawback of this method is that, if you want to copy anything out of a journal, you spoil it by having to rule lines over it. The method which I have always used and which has proved itself very practical, is the following: Say a drawing is required one-third size. In one corner of your paper draw a right-angled triangle so that the sides which enclose the right angle are to each other as three to one, as in annexed diagram. Take any line of the larger drawing in the compasses and measure it off on the line a b; let us suppose it to be B D, from D draw a straight line D F, parallel to

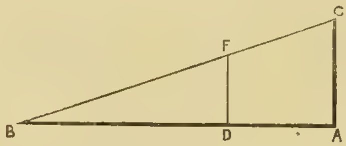


DIAGRAM ILLUSTRATING REDUCTION TO SCALE.

A C. This will represent the line d b reduced to one-third size, as it is required for the reduced drawing. For very large drawings this method is not convenient, as the triangle has then to be also of a good size. The proof of the correctness of this method is as follows:

$$\Delta\ ABC \sim \Delta\ DFB$$

because the triangles are similar, and all similar angles in them are equal. Then

$$\frac{fd}{db} = \frac{ca}{ab} = \frac{1}{3}$$

Twisted Work Without Apparatus.

IGNORAMUS.—There are two sorts of twisted work, the ordinary, which looks like a coarse round threaded screw of quick pitch, which may be seen on whatnots, and when larger, on legs of tables; and the open or corkscrew twist, usually of several threads, seen on candlesticks. All these can be very well cut out with the saw and gouge by hand, and smoothed with sand-paper in the lathe; probably most of them are done so. They can, however, be carved out with the gouge while in the lathe, the pulley and work being held and slowly turned by the left hand. This requires skill and practice, and would be best learnt from a person accustomed to such work. I happen to know of a man in Hastings, who is willing to teach the art of doing twisted work—Mr. S. Thwaites, *Hazlehurst, Braybrook Road.* I was much surprised to see the excellent work he had done with the plainest of lathes. Mr. Thwaites prefers to make the pitch of his twists increase gradually, and marks them out by wrapping round the blank a piece a paper ruled with inclined lines, of which each line has a slightly greater inclination than the preceding one. He then cuts them in the lathe with gouges ground obliquely. It is a great matter to choose a good piece of wood of, say, pear or olive. I may add that I have done twisted candlesticks with the traversing bar."—F. A. M.

Cart and Carriage Making.

J. A. (*Whitby*).—Previous arrangements for papers on this subject have fallen through. CATO was going to tell us how to make a light market cart, but was called away to some other part of the world, and so was prevented from carrying out his intention. The writer of the papers on making a Basket Perambulator also failed me. I have recently had proposals from a third writer, but it is beyond me to say whether he will come to the scratch or not. I cannot give papers on Sewing Machine Repairing, because the instructions given would, of necessity, be hypothetical. If you are in any difficulty on this point write and say what you wish to know, and, if possible, help shall be given you.

Vehicle Moved by Spring.

STADT DRESDEN writes:—"In my reply to JACK, I had in my mind a patent spring-driven tricycle, the two springs of which cost £10. The machine when tried realized about 8 miles an hour, but required re-winding every 2000 metres." [Kindly give name of tricycle and maker.—ED.]

The Naxos Union Company.

STADT DRESDEN writes:—"There appears to be more than one company of the above name. I wrote, as I said I would, to the one I deal with, asking for the address of their English agent. After waiting a month or so, a reply came that they had not as yet any agent in England, and asking me to find them one. This I consented to do, and a considerable amount of letter-writing ensued. That was some time ago, and I thought everything was settled. However, it did not seem to be, for though I wrote more than once, asking what decision had been arrived at, I could get no answer. I see in page 192, a correspondent has given the address of another company, which perhaps will do as well. I have been unable to write before, as several people seem to have mistaken me for a general agent, and I have been swamped with correspondence on matters I neither understand nor take any interest in." [There is, or ought to be, but one "Naxos-Union" Company. The correspondent to whom you refer does not give the address of another company, but merely points out where the Naxos-Union Emery Wheels can be obtained in London. I am sorry that people should have caused you trouble and annoyance by taking it into their heads that you were a general agent, and "swamping" you with correspondence, but the people who fell into error and caused the inundation could not have been readers of AMATEUR WORK, seeing that your name and address are not known to them, so the trouble has not arisen from your contributions to "Ours."—ED.]

Modification of Slide Rest for Shaping.

STADT DRESDEN writes :—" I submitted my sketches, re ' Modification of Slide Rest for Shaping,' to you in order to show how the arrangement might be efficiently constructed. I do not claim the invention of the large sketch, for, *as I stated in my letter*, it is merely the adoption of the ram of the lever-shaping machines to a slide rest. I did not expect you would publish it, or even look at it, for the matter of that." [To begin with, let me assure you I look at everything that is sent to me, no matter whence it comes. Part 65 for April was published on or about March 25th, and March 30th brings me the above remarks, showing that Part 65 must have come into your hands as soon after date of publication as it possibly could. This is just as it ought to be, and I have hope now that AMATEUR WORK will come into your hands regularly at the earliest possible moment after publication.—ED.]

Clip for Holding Screws, etc., in Vice.

J. A. (*Whitby*) writes :—" I send you a sketch of a very useful contrivance for

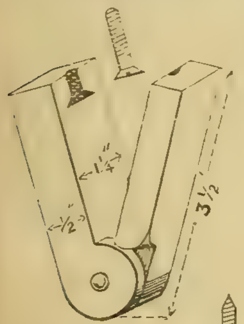


FIG. 1.—CLIP FOR HOLDING SMALL SCREW, ETC., IN VICE.

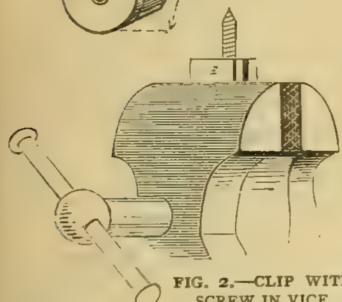


FIG. 2.—CLIP WITH SCREW IN VICE.

holding short rivets or screws in vice when filing them. It needs no description, as the drawings explain themselves and the method of using the clip. The dimensions of the clip are given in Fig. 1."

The A B C of Turning.

TREADMILL writes :—" I should like to make a suggestion regarding your valuable periodical. I have recently purchased a plain 5-inch lathe, and for the last four months have devoted three or four hours a day to the task of acquiring the art of wood turning, not, I fear, with much success at present, although I have had the assistance of a skilled professional turner. If I had not been within reach of such assistance, I must have abandoned the pursuit as hopeless. There must be many beginners in the country and small towns who are in that position and with nothing to assist them but AMATEUR WORK, 'Turning for Amateurs,' and 'Every Man His Own Mechanic,' the majority of such, I fear, must give it up, and take to something easier. The articles in AMATEUR WORK which treat of turning presuppose an amount of skill which must be exceptional in amateurs. Mr. Lukin, in his book, says a good deal about lathe building, ball turning, screw chasing, eccentric chucks and metal turning, but the unhappy beginner with, say a 2½ inch square piece of deal by 2 ft. 6 in., which he wants to turn into the leg of a table, will search his pages for help in vain. Every stage presents a new difficulty: (1) he must centre it correctly; he has to make notches with the gouge, and judge by them if it be properly centred; should his fork chuck shift, a not unfrequent occurrence, he will find screw chasing a joke compared to the trouble he will have. (2) He must rough it down with the gouge; very simple if he knows how; then he must smooth down the square end, not at all easy. (3) Comes smoothing down with a chisel. (4) The pattern consisting of beads, hollows, squares, etc. On all these points instruction is necessary, either personal or from books. The unhappy amateur who seeks help in AMATEUR WORK may learn how to build a 3-inch iron lathe or a 6-inch wooden one; how to make a compound slide-rest or a metal bell chuck or an eccentric hand-rest; if a spiral leg is mentioned, he is told to mount it in his lathe and show his skill in turning it; an article on fancy designs tells him how to manage eccentric discs, or flutings, or to cut a design on an egg shell, the simpler ones being dismissed in a few hurried words. I would suggest that some articles devoted to wood turning for beginners, with plain lathes and no expensive accessories, should be published in your Magazine. All the little details I have mentioned, and many more, should be gone into. If this were done I believe many a disheartened amateur would be induced to persevere; there would be fewer lathes 'nearly new' to be sold, and AMATEUR WORK, besides being invaluable to skilled amateurs, will be of much greater practical use to would-be wood turners like the writer."—[I am always ready to consider suggestions, and will give attention to yours. Lessons on paper are most helpful, but no one can expect to get on as fast by them and alone, as by a little *showing* by a practical workman. Anyone who has the will to do any particular kind of work, and is gifted with perseverance, will soon find out his mistakes and gradually get on the right path in elementary performances. However, I will see what can be done in the direction you intimate, for my desire is that "Ours" should be helpful to all—skilled and unskilled.—ED.]

Shipman Engine.

STADT DRESDEN writes :—" I did not expect to beat the Shipman Engine, that being a high pressure machine, with 120 lbs. working pressure. I want to design similar motor, but with a working pressure *below* the atmosphere. However, I am informed I may only have a gas or a caloric motor, and neither of these are admissible. In the first place, few Dresden houses are supplied with gas in the rooms; in the second, a one-horse power caloric motor is a very cumbrous affair." [Can anyone help STADT DRESDEN ?—ED.]

Another Hand Planer.

H. H. D. B. writes :—" I send a sketch of an easier and simpler way of making the

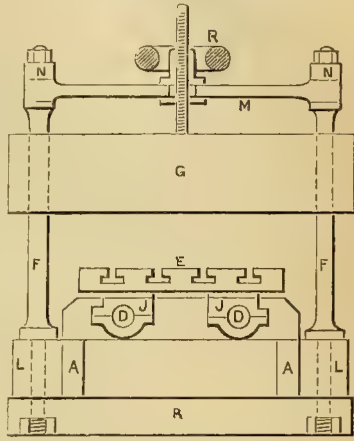


FIG. 1.—FRONT VIEW.

uprights for carrying the cross-slide of the planer, the drawings of which I sent a little while ago, and which were engraved and inserted in page 190 of the present volume. It will be seen that the uprights consist of two turned rods, F, F, fitted into holes bored in pieces of hard wood, L, L,

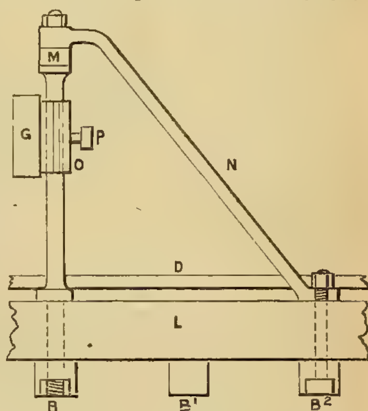


FIG. 2.—END VIEW.

R, Fig. 1, shows how an arrangement could be fitted to raise and lower the cross-slide. This is not shown in Fig. 2 to avoid confusion.

which are screwed to the sides, A, A; these rods also pass through the crosspiece, B, and are secured by a nut let in flush with the bottom of B. At the top they are held by the brace, M, and the stays, N, N, which latter are also fastened to L and B^2 by the bolt shown in the drawing. The bearings, O, of the cross-slide, slide on the rods, F, F, and the cross-slide is clamped to them in any position by the set-screws, P. If anything is not quite clear I shall be glad to answer any questions through the usual medium."

Gums for Setting Artificial Teeth.

SREYM.—In reply to your inquiry, "What are the component parts used in making the gums for setting artificial teeth in"; if you mean to ask for the component parts of a vulcanite "base" plate and gums in which you will find artificial teeth fixed, I may say that:—

(1.) Caoutchouc, 48 parts, sulphur, 24 parts, give a black base.

(2.) Caoutchouc, 48 parts, sulphur, 24 parts, white oxyde zinc, 30 parts, vermilion, 10 parts, give a red base.

There are scores of makers in the market, each of whom have private formulæ of their own. Any dentist other than a wholesale firm would let you have some ready prepared, but all depend upon the first given, and colour in various ways. It cannot be reduced to a liquid form without destroying its value altogether for dental purposes. It is hardened under steam pressure of about 75 lbs., and at a temperature of about 315° Fahrenheit, after which process it is useless for any other purpose except the form in which vulcanised. You do not state whether it is required for dental purposes or not. If not, it can be dissolved in bisulphate of carbon, which, when dry, will leave it nearly in its original state, plastic as indiarubber. Or is it possible that you wish for a dissolved gum to attach tube teeth to the pins that pass through them. Then dissolve best gum mastic in methylated chloroform, sufficient to make a thick varnish, apply to the pin and the inside of the tube, and allow to set. A little floss silk wound round the pin, if it is much worn away, will with this prevent its shaking.

A Reason for not Subscribing to "Amateur Work."

STADT DRESDEN writes: "I do not subscribe to AMATEUR WORK, because, being a monthly journal, I can't have a subscription for a quarter or half a year, and I don't like to have a longer one, as my future movements may at any time become erratic." [Oh, yes, you can! The Publishers will be happy to accommodate you with a supply of AMATEUR WORK for any period under a year.—ED.]

Fret Cutting, Wood Carving, Etc.

F. R. GRASSBY, 26, *Salthouse Lane, Hull*, writes:—"For the information of ESOR and others, who may be seeking assistance in Fret Cutting, Wood Carving, etc., I beg to say that I am willing to undertake all kinds of wood carving, modelling, casting, and fretwork to order. Small figures and any kind of wood carving closely roughed in for amateurs to finish, or finished as required."

SIDNEY A. HOLLAND, 5, *St. Mary's Road, Southampton*, writes:—"Seeing in Amateurs in Council that the names of persons willing to cut fretwork are wanted, I should be pleased to cut any patterns or designs sent me."

Single Stroke Electric Bell.

FARIDA.—Simply dispense with the contact post and spring at the back of the hammer armature, and connect the wires of the magnet direct to the binding screws on the base. No diagram needed to illustrate this.—G. E.

INFORMATION SUPPLIED.

Repair of Leather Binding.

FENMAN.—You say that the leather binding of your copy of "Spectator," last century, is so dry, that by constant use it is cracking at the joints. Nothing can be done to leather that has dry rot. Your best way will be to re-cover.—Author of "BOOKBINDING FOR AMATEURS."

Split Cases for Binding.

FENMAN.—Split cases can be had from Messrs. Birdsall and Son, *Northampton*, who have patented the process. In appearance these look like an ordinary cloth case, but the boards are double and the cord is placed between the boards, which is pasted when pasting down.—Author of "BOOKBINDING FOR AMATEURS."

Electric Apparatus for Lighting Lamp.

Mr. G. EDWINSON writes in reply to SOUTH AUSTRALIAN (page 240):—"I have just completed the drawings of an ingenious apparatus for lighting a lamp by means of an electric current, or released spring, or the descending weight of a clock. These, together with a written description of the apparatus, will soon be in the Editor's hands."

Ornamental Wrought Iron Work.

Mr. G. EDWINSON writes in reply to SCOTUS (page 240):—"The illustrated catalogue of Messrs. Baylis, Jones, and Baylis; 'The Smithy and Forge,' by Crane; and back numbers of the 'Metal World,' all have illustrations of ornamental wrought iron work."

H. L. BENWELL writes in reply to SCOTUS:—"The following will be found useful works bearing on ornamental iron work: (1) 'Metal Work,' by G. W. Yapp, published £3 3s., new; remainders can be had for about 17s. 6d. (I gave that for mine.) Try W. H. Smith & Son, who supplied me. Virtue & Co., *City Road*, 1851. (2) Clarkson's (D. A.), 'Ancient Ironwork from Thirteenth Century,' a collection of examples of balconies, balustrades, locks, keys, and hinges, etc. 48 finely executed plates, imp. 4to, cloth gilt, 21s.; published £4 4s. B T. Batsford, 52, *High Holborn, W.C.* (second hand). (3) Wyatt (Sir M. Digby), 'Ornamental Metal Work in Gold, Silver, Brass, and Iron, etc., from Twelfth to Nineteenth Centuries.' 56 large plates, folio. Published £6 6s.; second-hand copy costs about 35s. Further list if wanted."

Prices of Skins.

HENRY L. BENWELL writes in reply to M.:—(1) "Leather Trade Circular and Review," monthly, 6d., Waterlow Bros. and Layton, 24, *Birchin Lane, E.C.* The organ of the leather trade. A review of the various markets for hides, skins, tallow, bark and wool, and other useful information. (2) "Shoe and Leather Record," every Saturday, 1d. 30, *Finsbury Pavement, E.C.* A journal devoted to the leather and hide trades and boot and shoe business. Deals also with machinery, mercery, grinding, and tanning materials. (3) "Shoe and Leather Trade Chronicle," every Saturday, 2d. Allnut & Taylor, 28, *Paternoster Row, E.C.* (4) "Leather," 4d. 9 and 10, *St. Bride's Avenue, Fleet Street, E.C.*

INFORMATION SOUGHT.

Electric Gas Lighter.

KING TOM asks:—Will any reader of AMATEUR WORK give me a description of, or any information about, the Electric Gas Lighters now used?

Flax and Hemp.

FLAX writes:—"Can anyone give me hints how to proceed to convert flax and hemp (plants) into the raw material? Are there any complete works published on the subject? Could you put me into communication with some one who understands the process?" [Will some of our friends in the North of Ireland reply to this correspondent on the subject on which he writes. FLAX should send his name and address, so that letters from persons ready to enter into communication with him may be forwarded.—ED.]

Gas Engine for Lathe.

H. H. D. B. asks:—Will some contributor kindly give a description of a small gas engine, suitable for driving a 4½ or 5 in. centre screw-cutting lathe, band saw, etc. (one at a time)? How are the valves worked, and would a double or single-cylindered engine, both to develope about the same power, be best? I should also be much obliged for answers to the following:—(1) What ought diameter of supply pipe (gas) to be? (2) Size of gas-bag? (3) Best way of making pattern for cylinder? (4) Area of ports in relation to bore of cylinder? (5) Size of flywheel? (6) Size of bore, and length of stroke of engine, for above purposes? Any other information on this subject will be greatly esteemed.

Dog Kennel.

PIRIE (*South Africa*) writes:—"Will you kindly give me a design and details of a Dog Kennel suitable for a pair of setters, also large enough for their young. Should like something different to the old gable-shape roof." [There must be many besides PIRIE who would like information on this subject. It seems, however, that something more is wanted than a mere wooden box, and that provision should be made for the separation of the dogs when necessary.—ED.]

Skate Makers.

STADT DRESDEN asks:—Is there any small maker of skates in England who would make a few small parts for a skate which has a new way of fastening?

Melting Point of Antimony.

STADT DRESDEN writes:—"Mr. Edwinson says, in page 191, antimony melts at 1150° Fahrenheit. Is not this a slip of the pen, as in Molesworth's Pocket Book and the Brassfounder's Manual, by W. Graham, 810° is given?"

LETTERS RECEIVED UP TO APRIL 6.

A. S. (*Battersea*); GROOVED BARREL; R. W. W.; J. S.—Replies to queries up to March 9 not yet received. H. W. (*Glasgow*).—Reply in next Part.

STADT DRESDEN; S. M. L. (*Goderich, Canada*); C. A. PARKER; H. S.; TRIO; H. C. (*Manchester*); MESSRS. CHARLES CHURCHILL & Co.; H. J. W. (*Newport, Mon.*); H. H. D. B.; SARRUSOPHONE; GROOVED BARREL; W. H. (*South Hackney*); S. EDWARDS; TREADMILL.

WOOD-CARVING IN IRISH BOG OAK.

By ALEXANDER WATT.

I.—BOG OAK OR BOG WOOD—ORIGIN AND PROGRESS OF CARVING IN BOG OAK—SELECTION OF THE WOOD—TOOLS REQUIRED—SPECIAL TOOLS—SHAMROCK VEINING TOOLS—HOW TO MAKE A VIEW BROOCH.

AS a pleasing indoor pursuit for amateurs, wood-carving has much to recommend it, and when skilfully used and tastefully performed, the finished article, it may be said with truth, is always an object of interest and admiration.

The substance to which we would direct attention, as being particularly suitable for amateur carving, is that known as Irish bog oak, or "bog wood," a product of the bogs of Ireland, and remarkable alike for its intense blackness and the peculiar toughness of its grain. These bogs, beside yielding turf of most excellent quality for fuel, give up a considerable quantity of solid timber, chiefly oak, in a high state of preservation, and apparently undergoing by slow degrees the process of conversion into coal. Bog oak, as this material is termed, had frequently been dug out of the Bog of Allen, and other native bogs, in the early part of the present century, but was not turned to any special use, we believe, until it occurred to an ingenious old soldier, named McGuirck, to make ornamental articles, such as brooches, paper-knives, shamrock studs, etc., from the material, and for many years he derived a comfortable income from the pursuit. At his death the business was carried on by his son-in-law, a goldsmith and engraver of considerable ability, by whom some exquisite specimens of bog oak carving were produced, his work being much sought after by the Irish nobility and gentry, whilst many illustrious personages, when on a visit to Dublin, availed themselves of the opportunity to possess specimens of this well-known carver's handiwork. The rapidity with which the native ornaments obtained purchasers, even at very high prices, induced many imitators to enter the field of competition, and at the period of which we are writing (about the year 1848) at least half-a-dozen bog oak carvers were established in the City of Dublin, while others followed the art in Cork and elsewhere.

At the period of the Irish Rebellion in '48, bog oak carving had attained a high degree of popularity, which greatly increased until the year 1851—the "Exhibition year"—when the native industry may be said to have reached its height in public estimation, and furnished employment for a considerable number of persons. The art of bog oak carving was not alone practised as a source of profit, however, for many amateurs—amongst whom may be mentioned the accomplished daughters of the late Earl of Howth—devoted themselves to the pursuit as a recreative amusement, for which purpose, as we have said, it is specially suitable.

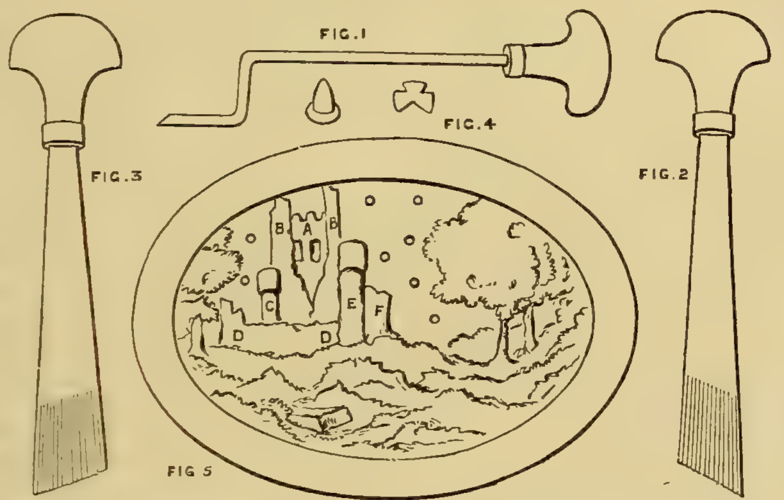


FIG. 1.—DOG-LEGGED TOOL. FIGS. 2, 3.—SHAMROCK VEINING TOOLS. FIG. 4.—STAMPS OR PUNCHES FOR BORDERS, ETC. FIG. 5.—DESIGN FOR VIEW BROOCH.

With a view to aid those who may desire to try their hand at this pleasing art, we purpose giving such practical instruction as will enable them to readily acquire the manipulation of the necessary tools, when practice and a little adroitness will soon render the student—especially if possessing a taste for drawing—an expert.

Selection of the Wood.—Bog oak of good quality should, when cross-cut with a tenon saw (or, by preference, a circular saw), exhibit a black surface perfectly free from flaws or cracks, except, perhaps, at its extreme edges. Its grain resembles that of the ordinary oak, in which respect it differs from ebony—or "African bog oak," as it is termed when fraudulently sold as a substitute for the former—which has a much closer grain. When cut with a sharp chisel bog oak exhibits a peculiar toughness, unlike ebony, which is considerably harder and shorter in the grain. Such samples as are of a brownish colour instead of

being black, and show a porous open grain when newly cut, should be rejected, as also all pieces in which radiated cracks, approaching the centre or heart of the wood, are visible. Finally, the timber should be solid and heavy, and exhibit a deep black colour wherever cut with a sharp knife or chisel.

Tools required.—An important feature in bog oak carving, and one which the amateur will no doubt appreciate, is that when applied to articles of moderate dimensions, such as brooches, crosses, paper-knives, etc., comparatively few tools are required, and these are of a very simple nature; indeed, there are few mechanical arts in which such a variety of interesting objects may be formed with so few tools, and none of these are either costly or difficult to handle. Since several of these, however, are of a peculiar form, and may not be procurable at an ordinary tool shop, we will describe the method of making them, which the student may readily accomplish, or if he prefer it, may have them prepared for him by a tool-maker.

Of the ordinary tools the following will be required: A tenon or frame saw, for cutting transverse slices of the wood; one or two gravers, say one square and one lozenge graver; several keen-cutting half-round files suitable for wood-work; one or two small "scorpers," such as wood engravers use; a $\frac{1}{4}$ inch chisel, set in a graver handle; an American drill stock and set of drills for perforating wood; a small gouge (about $\frac{1}{8}$ inch) set in a graver handle; an oil-stone for sharpening tools, and a few sheets of glass-paper, from coarse to fine.

The *Special Tools* are: 1, a tool called the "Dog-egged Tool," a sketch of which is shown in Fig. 1, may be easily made as follows: Obtain a piece of flat steel about 5 inches long, $\frac{1}{8}$ inch wide, and $\frac{1}{16}$ inch thick; hold one end in a pair of pliers, and make the other end red hot in a clear fire. While in this state bend it at a right angle either with a second pair of pliers, or in a vice, about $\frac{3}{4}$ of an inch from the point. Again heat the piece of metal as before, and make a second bend, also at a right angle, about $\frac{5}{8}$ of an inch upward from the first bend. Now cool the metal in water, and then with a file form upon the upper surface a sharp face like that of an ordinary chisel. Before doing this, however, it will be necessary to file the point of the larger end, so that it may be driven into a handle as shown in the engraving. Having ascertained that the tool is of the proper form, its long end must be again held by the pliers, and the bend placed in the fire until quite red hot, in which state it must be promptly plunged into cold water. This is termed *hardening*, and in this condition a file will make no impression upon it. The tool must next be *tempered*, which is accomplished thus: First rub the face of the tool upon the oil-stone until it shows a good cutting edge, and then place the longer end a short distance only in the fire, and when this has become red hot, hold the shank in the pliers until the clear face of the tool assumes a pale straw colour, when it must be at once dipped in cold water. The tool is now tempered, and may be rendered bright, if desired, by rubbing with emery cloth moistened with a little oil, and placed over a piece of flat wood or an old file. It is now to be fixed in a graver handle, to which it must be firmly secured by tapping it with a hammer. This tool is used for producing rough or jagged surfaces in certain portions of the work to be described in the next paper. In using this tool the handle is placed in the palm of the hand, with the shorter end downward, and is rocked to and fro upon the wood by a wrist movement, sufficient pressure being given to form zigzag indentations, and these are afterwards cross-cut in the same way until the desired effect is produced; further details concerning its application, however, will be given hereafter.

2. Shamrock Veining Tools.—These tools, of which two will be required—one cutting downwards from the right, and the other from the left, of a shamrock leaf—are used for forming the veins which are a special characteristic of the trefoils, but more particularly the variety known as the shamrock, or *shamrogue* (*Trifolium repens*). The form of the veining tools is shown in Figs. 2 and 3. They are each made from a piece of flat soft steel, $\frac{1}{4}$ inch wide, $\frac{1}{16}$ inch thick, and about 3 inches long, and are fitted into graver handles. To form the cutting surfaces of the tools a series of rather deep lines are cut from the extreme edge upward, that is towards the handle, with a graver; as shown in the cuts; these lines or grooves should be perfectly equi-distant, and as true as possible. The ends of the tools must next be filed, so as to give them a chisel edge, making the angles of each tool to correspond with the other, though in an opposite direction. The tools being thus prepared are afterwards to be hardened and tempered as before, and the cutting faces then sharpened upon an oil-stone.

3. Small Stamps or Punches, for impressing designs upon ornamental borders, or other parts of carved bog oak work, may be readily formed from pieces of steel wire about 3 inches long, and from $\frac{1}{8}$ inch to $\frac{3}{16}$ inch in diameter. One end of the wire is first filed to a point, which is then driven into a graver handle. The opposite end must next be filed perfectly flat, and the design—say a shamrock leaf or acorn, as shown in Fig. 4—sketched on the surface with a fine-pointed lead pencil. The tool being held firmly in the left hand, is allowed to rest on the corner of a table or bench; now, with a fine keen-

cutting half-round file, make a groove between each of the leaflets of the sketched shamrock, allowing the groove to extend about $\frac{1}{8}$ inch below the flat face of the tool, that is, on the shank in the direction of the handle. When the three grooves are thus formed, proceed to file away the metal on each side of the respective leaflets, taking care to round them off as shown in the woodcut. The wider space, where the stalk of the leaf would naturally be, must next be formed by the file, care being taken to preserve the uniform character of the three leaflets. When the operation has been skilfully and neatly performed, the tool, after being heated in the flame of a candle or lamp, should produce an impression upon wood corresponding to the illustration ; this should not be made too deep, however, but merely a little below the surface.

With respect to the small chisels used in bog oak carving, it may be useful to the student to know that these may very easily be made out of small old flat files. Take, say $\frac{1}{4}$ inch flat file, make it red hot, and allow it to cool ; cut it across with a file, leaving about $2\frac{1}{2}$ inches of the filing surface beyond the tang. Having done this, fix the tang into a graver handle, and, with a clean file, obliterate all the file cuts, especially towards the end where the cutting face is to be formed. The surface may now be rendered smooth and bright by means of emery cloth placed over a flat file as before. The cutting face is next to be formed, as for an ordinary chisel, and after hardening and tempering, the tool merely requires to be faced on an oil-stone, when it is ready for use. It is scarcely necessary to say that before the hardening, etc., of the chisel are performed, the handle should be removed, which is readily done by giving the ferrule of the handle a few sharp taps with a hammer.

To make a View Brooch.—If we except the Irish harp and the shamrock, probably no bog oak ornament has been so universally adopted as that which is termed the "view brooch," consisting of a landscape or old ruin, with a plain or ornamental border, representing, as it were, a framed picture. The subjects selected for this purpose in the Sister Isle are usually the ruins of old castles, "round towers," or scenes which have been immortalised by the native poet, Tom Moore. Each and all in their turn have been taken by the bog-wood artist as subjects for view brooches, from Blarney Castle downwards ; but no subject is more suitable, or makes a more effective picture when neatly executed, than the ruin of an ancient castle or abbey, with a sufficient amount of foreground, and a tree or two to relieve the outline of the object-in-chief. Of course the intending carver will suit his own taste in the selection of a subject, which need not necessarily be taken from Irish scenery ; but should this have his preference, he will have little difficulty in meeting with old engravings (possibly Finden's, which are admirable) to satisfy his taste.

To make a view brooch, the first thing to do is to obtain a small and sound log of bog oak—preferably a piece from a branch of moderate diameter, say about three inches. From this, several slices may be cut either with a tenon saw, or, if preferred, a turner possessing a circular saw may be applied to, and requested to cut off a sufficient number of slices for present use. Each slice should be a trifle over $\frac{1}{4}$ in. in thickness. Having a perfect slice of wood to operate upon, we next proceed to trace with a lead pencil two oval outlines—one about $2\frac{1}{2}$ in. in length, which marks the extreme centre edge of the object when finished, and a second oval outline, within the former and about $\frac{1}{4}$ inch away from it in all directions. These outlines should be as true as possible, and of a perfectly oval form. Since these pencil marks are apt to become obliterated, or partially so, while handling the wood in the operations of roughing out the design, it is usual to cut through the pencil lines with a graver, and since this may be the first time the student has handled such a tool, we may give him a hint as to how the tool is to be used, and advise him to practise the use of it, by making clean, straight and curved cuts upon the transverse section of any hard piece of wood. To hold the graver, the handle is to be placed in the palm of the right hand, and the steel shank, with its bevelled cutting face upward, must rest upon the first joint of the thumb (leaving the nail underneath) while the first finger presses the shank from above. If now the thumb be pressed against the piece of wood to be engraved, and the hand forced forward from the wrist, the graver will glide steadily along, and if the point of the tool be brought close to the wood, a clean cut will be at once produced, the depth of which will depend upon the angle at which it is held, and this should be almost imperceptible, otherwise the graver point will cut too deep. A little practice will soon enable the tyro to master the handling of the graver, but he must practise frequently upon pencilled tracings on wood before he will be able to guide the tool effectively.

After tracing the oval outlines, as above directed, whether they are afterwards engraved upon or not, we next proceed to draw an outline of the scene we intend to produce by carving. In the accompanying sketch (Fig. 5) a design with an oval border is shown, just as the slice of bog-oak would appear after the superfluous timber had been cut away from the outer edge of the border, and the circular spots indicate where the wood must be perforated to aid us in clearing away such parts of the wood, inside the

border, as are not required in the scene. These perforations may be made with an American drill stock, but the drills must be exceedingly sharp or the operation will be tedious. It is well to form an ample number of these holes, so that when cutting away the surrounding wood, we may be less apt to split the timber. When as many holes have been drilled as are desired, we next take the small $\frac{1}{4}$ inch chisel, and cautiously cut downward, between any two holes, until an opening is made through to the back of the wood; the chisel is then held in an upright position, and being steadily forced downward, thin shavings are from time to time removed, and this manipulation is steadily and cautiously kept up until the other holes are reached, one by one, the operation becoming easier as the aperture widens. Care must be exercised, however, to avoid cutting into the border or the outline of the picture itself; the wood should be cleared away as close as possible without extending beyond the proper boundary, and a half-round file will do the rest when the carving is complete. When all the superfluous wood has been removed from the spaces beyond the drawing, we next proceed to cut away that which surrounds the outer oval outline, and this is most conveniently done by laying the wood, face upwards, upon a table or bench, and then with a chisel and hammer, or small mallet, cut off small pieces at a time until the edge is nearly reached, when the chisel alone should be used. When we bear in mind that the wood is only a quarter of an inch in thickness, it will be seen that a very slight tap with the *side* of the hammer will suffice to chip off small fragments, and if the chisel be held upright, and kept close to the wood, these pieces may be knocked off with great rapidity by a steady hand; a sharp, quick, but not heavy blow of the hammer is all that is required. We have known carvers to use the inner part of the right hand, a little above the wrist, in preference to either hammer or mallet for this purpose, and we mention the fact merely to show how light a blow only is needed for the purpose. (*To be continued.*)

REPOUSSÉ, OR RAISED METAL WORK.

By H. C. STANDAGE,
Author of the "Artists' Manual of Pigments," etc., etc.

VII.—EXAMPLE FOR PRACTICE—BEATEN WORK AS DESCRIBED BY THEOPHILUS.

I NOW proceed to give an example practically worked out. Fig. 36 represents a design suitable for a book clasp, or a centre medallion to be let into the top of a lady's workbox. This should present no difficulties after the instructions already conveyed. This can be raised on a sheet of thick lead, about three-quarters to an inch thick, or a bed of pitch held in a trough: a tin baking tray would form an excellent receptacle to hold the pitch composition. Flat-headed punches will be required, and a punch with a triangular face to stamp out the corners, A A. In the design, A A A, are two surfaces on the same level, while B B B is the raised part of the metal between them, C C C C being the sloping part towards the surfaces, A A A.

To execute this design, say in sheet brass, trace the design on the sheet of metal with the graver, then with a fine pointed punch outline this design by dotting it with a few punch marks, so that the design can be seen and followed on the reverse side; then proceed to thicken B B B by working up metal from both surfaces (inside and outside of the designs) A A, by the method of wielding the hammer, already described, for thickening metal. When you consider the metal sufficiently thick to allow of B B being raised upon A A to the requisite height, turn over the sheet of metal on the pitch bed, and then proceed to beat down B B by a series of thinning blows; let the first blows of the punch be in the middle of B B, and extend the blows outwards to C C, when the design is roughly worked out, turn the front side of the metal upwards again, and correct the design by beating down A A with flat-headed punches, and also get the sloping sides, C C C, as level as possible.

It is as well to have the pitch composition bed of sufficient size to permit the sheet of metal being worked both sides in different parts of the bed. For this reason the pitch bed is evenly smooth when beginning the work, but as the design is hammered out from one side, a negative impression of the design is formed in the bed, and if now the metal be turned, and hammered from the other side, the positive part of the design may fall on the negative part of the bed, and there will no longer be a level surface to work on, with the result the design will not be accurate; therefore, it is best to use one part of the bed to lay the sheet of metal on when hammering on its face and another part of the bed when hammering on the back of the metal.

To give sharpness to the angle formed on each side of B with C C, use square flat-faced punches, and let the edge of the punch be kept close to the angle edge. To raise B it is the metal that is hammered from the reverse side, and A is hammered from the front, in giving distinctness to the design at C. In the front of the dotted pattern, A is matted, *i.e.*, beaten all over its surface with a punch possessing a spherical or oval face, while the surface of B is left smooth. This example will test the skill of the operator, as to his proficiency in raising work without

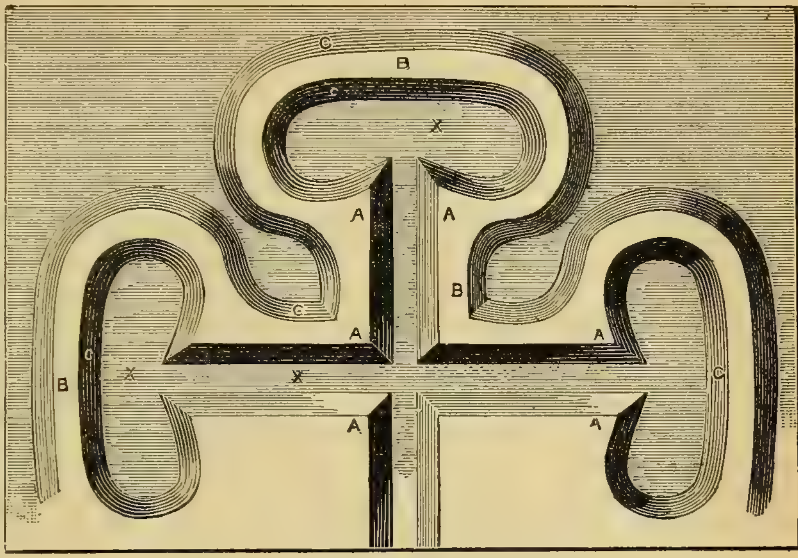


FIG. 36.—DESIGN FOR BOOK CLASP OR CENTRE MEDALLION OF BOX.

cracking the metal, for though formed by B and C being sharply defined, is very liable to be cut through with the punch edge if too severely hammered, or the metal have not been thickened sufficiently. While finishing the slope, C C, as required, smoothness of surface, distinctness of outlines, etc., the trench formed on the reverse side of the metal between C C, having B as a bottom may very conveniently be filled with pitch; greater decision of touch will thus be obtained—as an example, in raising a rounded ornamentation, as given in Fig. 37. In this figure all the repoussé work, or raised part of the metal, is rounded, and chiefly done from the back. To execute this design, trace the pattern on the back of the metal, and proceed to hollow out A with the round-headed hammer, perfecting the work at the edges with round-headed punches, correcting the outline in definiteness from the front. Then raise the rim B, which has a sharp edge; this is raised with a pointed or wedge-shape headed punch. Then raise the pieces E, forming the conventional floret. These are not fluted, but raised, the lightest part being in the middle and not at the sides, and each one is distinctly separate from the others. Correct the outline of these from the front with suitable shaped punches. The next step is to raise the circular rim D; this, like the rim B, is ridge-shaped; the centre E, of this floret is flat and level with the ground. Having raised the rim D, proceed with F; these are precisely similar to C, being raised above the ground and distinct from each other. They are raised by punches from the back of the metal, their outline being connected from the front. Having done F, proceed with G, in the same manner from the back, occasionally hammering the ground all round it from the face B, correct the level of the surface; G being finished, H claims attention next. To raise this part of the design needs special care and attention, because the sides of it rise perpendicular from the face of the metal (that is, they are not rounded off), and before so much metal can be hammered out, this part must be thickened, so as to allow of sufficient metal being there to form the sides. This metal is gathered up from the ground surrounding this portion of the design, and also by thinning the face of that part. If the metal is very brittle, occasional tempering of it by putting it on a red-hot shovel will be needed to prevent the metal from cracking at the edges, or walls that are raised from the ground. When the tyro has successfully produced designs 36 and 37 in repoussé, he is fully competent to undertake more intricate ones. Before doing so I would advise him to repeat the execution of these two designs several times, for each time he will gain fresh ideas in the manipulation of his

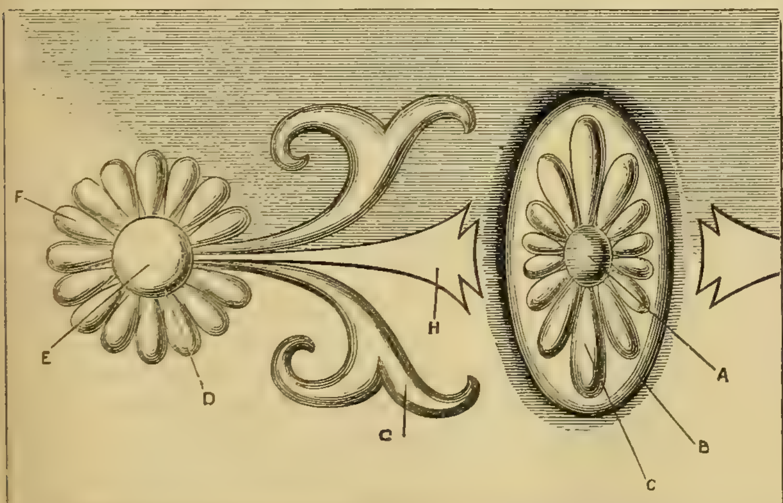


FIG. 37.—EXAMPLE OF ROUNDED ORNAMENTATION IN REPOUSSE WORK.

tools, besides greater expertness and skill, which will stand him in good stead when working out more elaborate patterns. In making his own designs, let them be such as are suitable for execution in metal; what is suitable to stone is seldom suitable for wood or metal, and *vice versâ.*

The following account of beaten work, as detailed by Theophilus, may be not uninteresting to the reader, as it illustrates how very precise in every detail were the ancient workers in metal:—

"Beat a gold or silver plate as long and wide as you wish for relieving the figures; which gold or silver, when you have first melted it, carefully examine by scraping or carving around it, lest perchance any bubbles or fissures may exist in it, which things often happen through carelessness, or negligence, or ignorance, or unskilfulness of the founder. When it is cast either too hot or too cold, or in too great haste, or too slowly. When you have considerately and cautiously cast it, should you perceive a fault of this kind in it, carefully sculp it out with the instrument fit for this work (an instrument somewhat like a graver, and used in the same manner) if you can. But if the bubble or fissure be of such depth that you cannot dig it out, you must again melt it, and so on until it has become sound. When it has become so, see beforehand that the anvil and your hammers, with which you should work, are quite smooth and polished, and take care that the gold or silver plate be so equally thinned everywhere, that it be in no place thicker than in another. And when it has been thinned so that the nail slightly pressed upon it may show upon the other side, and it is perfectly sound, directly portray the figures you may wish, according to your will. You design, also, in that part which is seen to be the most sound and beautiful, gently however, and so that it may slightly appear on the other side. You will then with a curved iron well polish, gently rub the head in the first place, which must be more raised, and so turning the plate upon the right side, you rub round the head also with the smooth and polished iron, so that the ground may descend, and the head be raised, and you directly beat around the head, with a middling-sized hammer, upon the anvil gently, and you then cook it before the furnace, until it glows; coals being superposed in that place. Which being done, and the plate cooled by itself, you will again rub it with the curved instrument on the underneath part, inside the hollow of the head, slightly and carefully; and turning the plate you will again rub with the smooth iron upon the upper part, and you depress the ground that the relief of the head may be raised, and again gently striking it with the middling hammer about this; you recook it by applying the coals, and thus you act often by carefully raising it inside and outside, and frequently hammering, as often cooking (*i.e.*, annealing), until the relief is brought to the height of three or four fingers, or more or less, according to the number of the figures. If, however, the gold or silver is somewhat too thick, you can beat it and thin it with a long and slender hammer, if needful. But if two or three more heads should be in the picture, you should do about each one as I have said, until the height which you may wish is attained. Then, with the tracing instrument, design the body or bodies of the figure, so that by depressing, and sometimes by beating, you will relieve them as much as it may please you; providing this, however, that the head be always the most relieved. After these things you will design the nostrils and eyebrows, the mouth and ears, the hair, eyes, hands and arms, and the other shadows of the draperies, the footstools, the feet; and you will raise these inside pieces with the smallest curved instruments: above all, taking care that it be not broken or perforated. But if through want of knowledge or negligence this should happen, it should be soldered in this manner: take a little of the gold itself, or silver, and mix with it a third part of copper, and melting them together you will file it finely, and vine stems being burnt and salt added, you will mix it with water, thinly anointing it with which spread the filing over the fracture; this dry, again anoint the mixture more thickly, and, coals being applied at once to below, you will blow gently until you can see the solder flow; seeing which, immediately sprinkle it with water, and if it be hard, well; if not, however, do the like again until it has become firm. Should the fracture, however, be broad, carefully join a small piece of the same gold or silver, equally thin to it, which you will solder in like manner until it adhere everywhere. And when the relief shall have been carried to the point of the chasings, should it be gold, you immediately make them, and polish carefully, and you will colour it with "atrament," *i.e.*, green vitriol, or sulphate of iron, burnt to redness (whence it becomes oxide of iron), and salt. Should, however, the picture be silver, and you should wish upon these figures to gild the crown, the hair, beard, and portions of the draperies, this should be done before the fine lines are made, in this manner: arrange two parts only of clay, finely ground, to a third of salt, and mix them together in a small vessel with the dregs of beer, moderately thick, with which mixture you cover all the silver which you may wish should remain white, and that which is to be gilt can remain bare. When you shall have dried this over the embers, you will gild the places one by one without water; being gilt, you will wash it, and polished, you will colour it. Then, with finely pulverized charcoal, and with pieces of wood, larger and

smaller, you will rub it carefully until it be equally bright everywhere; you afterwards make the fine lines both on the gold and on the silver, which in the making you likewise polish until you bring it to perfection. When you wish to affix these gold or silver plates, fully relieved and polished, take wax and melt it in an earthenware or copper vessel, and mix till finely ground with it a sand, so that there may be two parts of this and a third of wax. When this has been likewise melted, you will sharply stir it with a wooden spoon, and fill up all the figures with it in gold, silver, or copper, or whatever may have been relieved in them, and when cold you will attach it where you wish. Also in copper plates, thinned in the same manner, the like work is made, but with greater attention and care as to strength, as its nature is more hard. When this work has been brought to the fine lines, it should be cleaned on the outside part with a woollen cloth and sand until the black coat be taken off, and so be gilt and polished, and, the drawing being finished, be coloured and filled with the above-mentioned composition."

The above precise details illustrate how painstaking the ancient metal-workers were in every particular, every branch, for the beating out of the metal, the soldering it on to a plain vessel, the gilding of it, etc.; and modern repoussé workers would do well to follow so excellent an example if they want to attain to something more than mere successful manipulation in the production of the relief they attempt—that is, if they desire to attain perfection in every detail. We have only room for the following account, taken from the same writer, of "Beaten Metal Work which is Sculptured."

"Beat a copper plate as long and wide as you wish, so thick that it can scarcely be bent, and let it be sound, free from all cracks and blemishes, and portray the figure upon it which you may wish. Then beat the cavity in the place of the head with a moderate round hammer, on the under side, and around it, on the upper side, with the slender hammer, and so cook it in the embers. This being cooled by itself, you will do so throughout the whole figure with the hammer as you did in the thin copper, with the curved and smooth irons, and always depressing it on each side and frequently reheating it; and when you shall have relieved the figure as high as you wish, take irons, easy to the measure of a palm, thicker at one end, upon which it may be beaten with the hammer, and at the other more fine, round, and pointed, which you had prepared for thin work, and the boy* initiated in this art sitting before you, hold the plate in the left hand and the irons in the right, the boy striking upon them with a moderate-sized hammer, you will design the eyes and nostrils, the hair, and fingers of the hands, the articulation of the feet, and all the drawings of the garments upon the upper side, so that they may show inside, where also you strike with the same irons, that the designs may be raised outside. When you have done this until the figure be altogether formed, you sculp with the sculping and scraping instruments about the eyes, nostrils, the mouth and chin, and ears, and you will design the hair and all the fine drawings of the draperies, and the nails of the hands and feet; which being done, if you wish to decorate the crowns of the figures with gems, enamel, and pearls, immediately work single pieces in gold with wires, and solder as above in the work of the chalice, and fitting each one in its place, make holes through which they should be fastened on, namely, under the larger gems, and equally in the copper, and you will thus gild the plate, and you polish it first with the brass wires, as above, then with the smooth irons, and thus you will colour it, and you fix it on the pieces of gold, each one in its place, and you lay on the glass, and you will fasten the pearls around. In this same manner, should you possess facility for invention, you can make figures in gold and silver upon the books of the evangelists, and missals, and animals, and small birds, and flowers outside upon the horse-saddles of matrons. Upon gold or silver cups or platters in the middle, knights are made in the same manner, fighting against lions or griffins. The figures of Samson or David breaking the mouths of the lions, alone also, and griffins, the same also, each strangling single (figures of) cattle, or anything which it may please you, and which may be proper and fit according to the size of the work."

The "sculping" irons above referred to are thus described by Theophilus:—

"Sculping irons are also made for hollowing out in this manner. The instrument is made from pure steel, the length of the fourth finger, and as thick as a straw, but thicker in the middle, and square. One end is placed in a handle, and at the other end one side must be filed from the upper to the lower angle, but the lower, which is filed slender towards the point, is larger: this being heated, is tempered in water. Many larger and smaller are made after this fashion. Another like kind is made square, but never broad and thin, and its edge is parallel with the breadth, so that two angles are above and the two below are easy to equal. In this fashion also many large and small are made. A round and thick iron, likewise a straw, is also made, the point of which is filed, so that the work which it makes be raised."

* The metal worker usually had a boy attendant on him to hold the work in certain cases, etc.

Of the composition called "Tenax," the following is a description :

"Grind a piece of brick or tile very small, and melt some pitch in an earthenware pot, and add a little wax. These being melted together, mingle the powder of the tile and stir it sharply, and pour it into the water, and when it has began to grow cold, dip both hands into the water, and macerate it for a long time, until you can extend and draw out the composition like a pin. You instantly melt this composition, and will fill the vessel (for which this composition is intended) to the top, and when it has become cold, portray in the body and in the neck whatever you wish, and taking slender ductile instruments and a small hammer, design that which you have portrayed around it by striking lightly. Then give the hammer to the boy, who may sit opposite you, and hold the vessel in your left hand and the instrument in your right, each one in his place, and make the boy strike them in whatever mode you please, slightly or strongly, and depress the grounds that they may become hollow and the work be raised ; and when you have beaten it once throughout, the vessel may be brought to the fire, eject the composition, and the vessel, being reheated and taken to the fire again, fill it and beat as before, and do this until you depress all the ground equally, and you fashion all the work so that it may appear as if cast. Above all, arrange that the silver of the vessel be so thick that when you have formed the work by beating, you may be able to chase, hollow, and scrape it properly with the sculping instruments, which being accomplished, if you wish, make the crest handles in the same manner (supposing the vessel to be a jug), and the spout where the wine is poured out ; then you will fasten with solder made with silver and copper, then you will ornament with nickel whatever you wish, and gild the remainder as above. You make in the same manner gold and silver cups and plates, and boxes for placing the wafers* and incense caskets, also handles for knives, and figures upon crosses, and missals in gold, or silver, or copper."

In these instructions we observe that the figures on a vessel were raised by depressing the ground ; there is another way also of raising them, but one much more tedious, and in the hands of a not very skilful operator less successful, and that is by swaging tools. These are pieces of stout steel wire, bent to go into the vessel, and the end that enters the vessel shaped like the various punches used by the outside method. To use these tools for the production of raised figures, etc., the end inside the vessel is made to jar or vibrate against the inside of the vessel by striking with a hammer the end that projects from the mouth of the vessel. Of course, the success of this method of working depends on the nature, force, and application of the blow given to the free end of the "swaging" iron. For the amateur, it is best to fill the vessel with "Tenax" for the purpose of getting a solid surface, and then raising the figures by depressing the ground.

These papers have run into greater length than the writer at first surmised they would; but if his hopes of seeing metal work become not merely a fashionable amusement in the hands of amateurs, but a real art work, are realized, he will feel that not one word too much has been said.

(*Concluded.*)

* Theophilus refers to the making of ecclesiastical utensils.

MAGIC-LANTERN SLIDES IN WATER COLOURS.

By ALFRED WREN.

THE art of painting slides for the Magic-Lantern in water colours, has at least the merit of cleanliness, if it can claim no other virtue. The materials are cheap, and there is no stove-drying required, as is the case when oil colours are employed.

It will be convenient to begin with a list of requirements—namely, glass, colours, and fixing varnish. We should do well to go to a glazier and get him to cut some dozens of squares, which he will do for a few pence. The size must be determined by the size of the condenser in the lantern, 3½ inches square is a good size where the condenser is 3½ inches in diameter, thus allowing a picture of 3 inches to be painted. The colours used may be purchased at any artists' colourman, from 2s. 6d. upwards. Barnard and Son's colours are very good, and so also are Brodie and Middleton's.

In addition to this, a china slant with several divisions, and an etching point, will be required. Fixing varnish is generally supplied with the box of colours, but I prefer to make my own, for this reason, that I can make about four times the quantity at home for the price asked for it at the shops. Here is the recipe : take two ounces of Canada Balsam and two ounces of Spirit of Turpentine, and dissolve by gentle heat; keep it well corked in a wide-mouthed bottle for use. The etching point, if not supplied with the box of colours, may easily be made by inserting a stout needle in a penholder or any round stick of wood. A small sharp penknife and a cake of Indian ink will complete the list.

The first thing necessary will be to thoroughly wash the glasses, and, if greasy, put a little common

soda in some warm water and let them soak for a few minutes, take them out and swill under the tap, rubbing them well with a small piece of wash-leather. Be careful to get all grease off them, as unless this is done, it will be impossible to paint on the glass, finish off with clean newspaper, which polishes the glass, and at the same time leaves no fluff behind it.

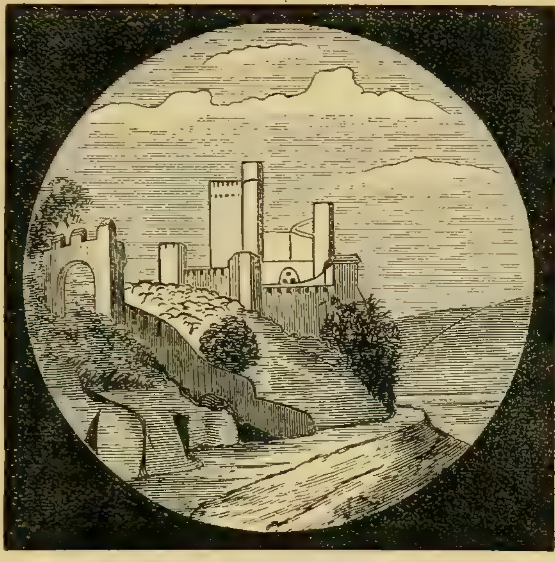


FIG. 1.—OUTLINE AND FIRST STAGE OF COLOURING.

The plates are now ready for the first coating of colour; it will be well to cover, say half a dozen before commencing to outline. First see there are no specks or blemishes on the squares, if so, reject them. Now with a full charged brush of colour (blue No. 2 if daylight, or blue No. 1 if moonlight views), go right over the square, wait until nearly dry, and then with the finger, gently dab the film till it presents a perfectly uniform surface. This requires a little practice before the knack is learned. If the colour dries too rapidly, breathe on it from time to time, which will moisten it sufficiently. When quite dry, proceed to varnish and place the square on its edge to set, which will not take longer than half-an-hour in a warm room. The varnish may be applied in the same way as a photographer would coat a plate with collodion, by pouring a small pool in the centre and tilting the glass from side to side till the whole is covered, or by coating with a brush.

FIG. 2.—THE PICTURE WHEN FINISHED IN DETAIL.

The brush system is the easiest to most, and if carefully used is as good as the other; be particular to lay the varnish on as smoothly and evenly as possible. Now get some brown, or any colour paper, so that it is opaque it does not matter, cut out some squares the exact size of the glass to be covered, that is, $3\frac{1}{4}$ inches, find the centre, and with a pair of compasses draw a circle of 3 inches, then cut out with some sharp scissors and stick on to the glass with paste or gum. (See Figs. 1 and 2.)

We have now a square of glass, tinted a light blue colour, and covered with a piece of paper with the central portion cut out in circular form.

The next operation is the outlining, which is the *bête noir* to many. To those, however, who can draw moderately well, it is easy enough; and I would recommend that the design be drawn direct on the glass, as it saves the time which must be necessarily spent in drawing on the paper first and tracing on the glass afterwards. If the latter plan is followed, the drawing can be readily traced as the colour is perfectly transparent. Whichever method is adopted, try to make the copy as near the original as possible.

I have omitted to mention an easel as a necessary in the list of materials, it is probably because I do not use one myself, that caused me to make the omission. If it should be a *sine qua non* with the reader, he could not do better than make one as previously described by Mr. Beckerlegge. When the outline has been drawn in satisfactorily, proceed to etch out the lights of the picture, using the etching point and penknife, carefully remove all dust and chips with a dry and soft brush. Varnish again and set up to dry. In Fig. 1 the painting has been advanced a stage; it does not do to fill up with colour until the outline has received a coat of varnish. I merely mention this as some probably would make a mistake, and by

so doing, blur the outline. The process of taking out the lights must of course be done directly after drawing in the outline, and before giving the plate the second coat of varnish. It will be convenient to describe now the picture, as we have it at this stage.

If all has been done properly, we see a circular picture correctly outlined on a blue ground, with the high lights of the clouds, castle, etc., etched out and ready to be filled in with their local colours after varnishing.

Now proceed to finish the painting, using all the skill you possess to render the picture bright and natural. Remember, too, never lay a wash of colour over another, until a layer of varnish has been first interposed. In the foregoing I have endeavoured to describe how to paint a daylight view. I have purposely omitted until now the method to be followed for painting sunset and moonlight effects, the latter of which is easy as very little outline is required. Use No. 1 blue, and proceed exactly as before described. Sunset views are the most difficult, but they will amply repay a little more trouble.

Take a perfectly clean square glass, and commence by laying on a light tint of blue, No 2, at the zenith and foreground of the intended picture, thus covering nearly but not quite two-thirds of the glass, dab it as before, gradually meltimg the colour away as it approaches the centre. Now varnish, and when quite dry and hard, paint the central portion with some amber tint the same strength as the blue, dabbing the colour till the gradations of colour are complete; varnish again, and proceed as before to outline.

In conclusion, I wish every one who undertakes slide painting in water colours, success, and if any difficulty should be experienced, I shall be happy to answer any queries in "Amateurs in Council."

Since the preceding paper was in type and ready for appearance in these pages, I have received from a new writer two articles of a series of six or seven on the same subject, that enter into the *modus operandi* of painting slides for the magic lantern in water colours in a full and exhaustive manner, entering in fact minutely into every detail, and into critical consideration of all kinds of colours, materials and appliances that are, or may be, used in this pleasing and useful branch of painting. I mention this because there may be many who may desire to be put in possession of more precise and ample instructions and hints than are to be found in the above helpful paper; and as the subject is one of importance to all who make use of the magic lantern as a means of instruction and amusement, I am glad to say that at no very distant period it will be resumed with profit, I hope, to all who may be interested in it.

AN OCTAVE COUPLER FOR THE HARMONIUM.

By A. J.

THE numerous queries for instructions to fit an Octave Coupler to the Harmonium, have induced me to write upon the subject; and I think that if the following instructions be carefully followed, any amateur of ordinary ability will be able to make and fit a coupler and two forte stops to his instrument. As, however, the sizes of instruments differ, I cannot give exact measurements, but shall give the measurements for one particular instrument, and amateurs must alter to suit their special requirements. Before commencing my instructions, however, I must say that the coupler cannot be properly fitted if the distance between the front and back rail of key frame is less than $4\frac{1}{2}$ inches.

The coupler is known as the wire coupler, and is used in American organs: in these instruments I must explain that the direction of wire is reversed, the organ coupler working from front to back, but in this one it works from back to front; the principle, however, is precisely the same in both cases.

Having introduced the subject, we will set to work. Take off the top of the harmonium by unscrewing the hinges or drawing the hinge pins. Take out the panel over the keys at back (if there is one: some instruments do not have them); next take off the rail over the keys at back of sharps; take out the back whilst you are about it, and put all aside until wanted. The keys are now exposed (I am supposing the instrument has no stops). Get a clean strip of thin wood about $\frac{1}{2}$ inch wide, and rather longer than the keyboard; place this on the keys, edge up, just in front of the back pins, and with a pencil, mark the centre of each key on it. This is the key scale, and is used to set out the coupler baseboard. Get out a piece of hard wood $2\frac{1}{2}$ inches wide, $\frac{5}{8}$ inch thick, and two or three inches longer than the keyboard. Plane this up *true*, this is important. Mark the top side, and run a gauge line along $\frac{3}{8}$ inch from each edge; mark one line front and the other back; make a mark also to show the middle of the length. Put the scale on one of these lines, and mark the board from it. Mark lines square across the board at these points, seeing that the middle mark on scale is in the middle of baseboard. Now draw diagonal lines, No. 1 line to No. 13, the line to commence at back gauge line, and finish at front line. Proceed likewise with No. 2 to No. 14, No. 3 to No. 15, and so on, to the end. You will now have forty-nine diagonal lines running

from back to front, commencing and ending $\frac{3}{8}$ inch from each edge, and as the square lines represent the middle of each key, you will see that the diagonal lines connect each key to its octave above. This must all be done very accurately, as the wires lay very close to each other, but must not touch.

The next thing is to make the coupler wires. Get a piece of iron wire, No. 10 gauge; about 40 feet will be enough; cut off 49 pieces the right length. To get the length, measure one of the diagonal lines, and add $2\frac{1}{4}$ inches; straighten them nicely, and bend 1 inch of one end at right angles; this is the *front* end of wire. The back end must be bent upwards for $\frac{1}{4}$ inch, and then bent again parallel with the front arm, but a little upwards. This is shown in Fig. 2, and at A in Fig. 3. This is to allow the back arm to clear the wires below it; each arm should then be 1 inch long. Flatten the ends of the arms, and file up the ends, and the wires are finished. The wires are kept in place by small wood blocks, one of which is shown full size at Fig. 2. To make these, get several pieces of hard wood a few inches long, and $\frac{1}{4}$ inch square; rough out one corner at each end with a small gouge, and finish with a small round file. Cut off $\frac{1}{2}$ inch long, and repeat until you have ninety-eight blocks. Drill the holes for the screws, and line the corner hollow with thin cloth, leaving $\frac{1}{8}$ inch of cloth over to go under the wire. I think Fig. 3 will make this clear.

We are now ready to screw the wires down. Get one of the wires and lay it over the No. 1 diagonal line, with the double bend at the back gauge line, and the other bend just touching the front gauge line. Take two blocks, and screw one at each end of the wire, the back one outside and the front one inside the bend as at B, Fig. 1, taking care that the projecting cloth is under the wire. Do the same with the remaining wires, place the scale on the ends of the arms, back and front, and see that the marks on the scale are at the middle of each arm; if not, shift the blocks a little. When all the wires are on, lay a piece of cloth across the wires under the arms at back, and fasten by a tack at each end; this cloth to be 1 inch wide. Screw a couple of small hinges under the front edge of the baseboard, as at C, Fig. 5; next get a piece of stout wire $1\frac{1}{4}$ inches long, screw one end, and flatten the other, and bore a small hole in the flattened end. Screw this in the middle of back edge of baseboard, as at D, Fig. 5. Take another piece of the same wire 4 inches long, bend $\frac{1}{2}$ inch of one end at right angles, and flatten the other end. Bore a hole in this end, and rivet loosely to arm in baseboard (E, Fig. 5), the bent end to be toward the bass end of keyboard.

The coupler is now ready for fitting. On the top of the keys, just behind the back pins, you will see a small rail, F, Fig. 4. Take this off, then lift off a few keys at one end; you will then see the front ends of the pallet stems. Measure the distance between the top of pallet stem and the under side of keys: this must be $1\frac{3}{4}$ inches; if not, the key frame must be packed. The thickness of packing is the difference between the distance from stem to key, and $1\frac{3}{4}$ inches. For instance, if from stem to key is $\frac{3}{4}$ inch, the packing pieces must be 1 inch. This is shown in Fig. 5, where G G are the packing pieces. In this figure all the additions are shown shaded, the original parts being in outline. We will now suppose that the distance *is* $\frac{3}{4}$ inch and proceed accordingly. First see that all the keys are numbered on top; if not, number them. Take them all off the frame and put aside. The key frame is held down by hinges at back and hooks in front; one of the eyes is shown at H, Fig. 5. Unfasten the hooks and unscrew the hinges, lift the key frame off, when the pallet stems will be exposed. These will most likely be partly covered with leather or swansdown; if so, remove it. The points of stems are clothed, which will be indented by the touch screws. Put a thin screw, 1 inch long, in each stem, $\frac{1}{2}$ inch behind this mark; see that they all stand out the same distance. Fasten a small cloth wad on the head of each screw, which may be done easily by warming the screw and touching it with elastic glue, and pressing the cloth on at once. The stems are now finished.

Now take the key frame and fill up the space between the rails at the bottom, with a panel $\frac{1}{4}$ inch thick, the grain running from front to back, K, Fig. 5; cut a row of holes in this, just over the stems in front, to allow the touch screws and coupler screws to pass freely, 1 in. by $\frac{5}{16}$ will be about right, next get two pieces of wood the length and width of the front and back rails of key frame and 1 inch thick, and glue them on to the rails, *i.e.*, make the rails 1 inch thicker; these pieces are shown at G, G, Fig. 5; next fit the coupler. Place it on the panel over the stems so that the front arms are over their proper screws, and mark where to cut the ends off. Cut them off and lay the coupler on the panel so that the screws in the stems are $\frac{3}{8}$ inch from front edge of baseboard; mark on the panel where the hinges come, and screw them down, fasten two pads under back of coupler, L, Fig. 5, and let it down; now fix the hinges on the back at the bottom edge of packing piece, M, Fig. 5, when the frame will be in the same position as before, but 1 inch higher, now bore six centre-bit holes through the back packing piece at each end, $\frac{1}{2}$ inch apart, 2 inches from each hinge, 12 in all. Dotted lines, O, in Fig. 4, show these. Get two pieces of wood 9 inches long $1\frac{1}{4}$ inch wide and $\frac{1}{2}$ inch thick, face these with leather and

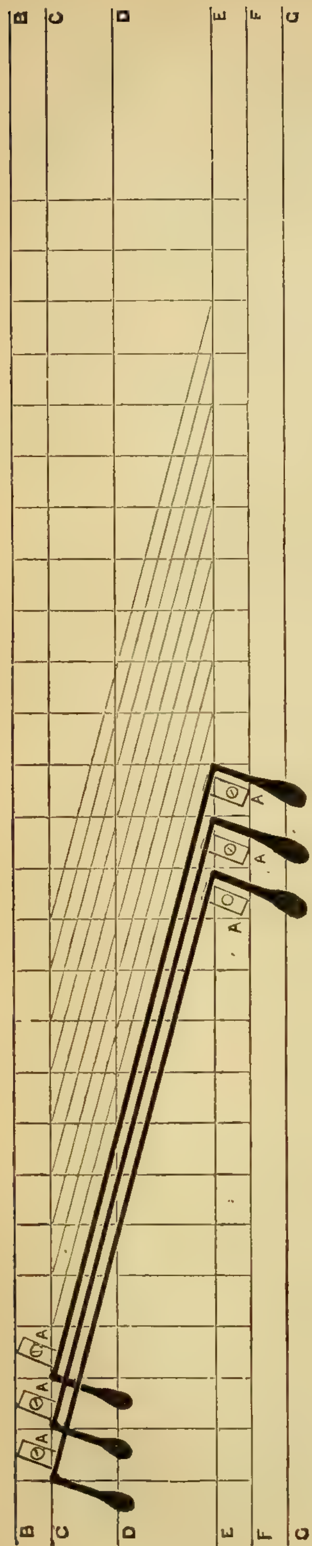


FIG. 1.—COUPLER BASEBOARD, HALF SIZE.—A, Blocks; B B, Back Edge of Baseboard; C C, Back Gauge Line; D D, Line of Coupler Screws; E E, Front Gauge Line; F F, Front Edge of Baseboard; G G, Line of Stem Screws.

bevel the edges as P, Fig. 5; hinge these over the groups of holes at each end, and fix springs to keep them closed, fix the screw eyes in front packing piece, hook down, and screw down hinges at back, and the frame is fixed. Now for the keys.

Take out the touch screws, and replace by $2\frac{1}{4}$ inch screws as thin as possible; if you cannot get them thin enough, you will have to screw some wires and put them in rounding the ends. At $2\frac{1}{4}$ inches behind these put a screw in each key, $\frac{3}{4}$ inch long, and clothe the heads the same as stem screws, see that they all stand out the same distance, namely, $\frac{1}{2}$ inch. Now put the keys on the frame, first cutting a piece out of two of them to allow coupler arm to pass, N, Fig. 5, screw on the slip, F, Fig. 4, not too tight, and proceed to the stop action. Get a piece of wood as long as the keyboard, $3\frac{1}{2}$ inches wide and $\frac{1}{2}$ inch thick, get another piece, same length and thickness, but 3 inches wide, plane these up and join at right angles, the narrow piece to be 1 inch from the top of the other. Now fix your ruler or piece that was over the keys, to the front edge of the narrow piece; the method of doing this is shown at 1, 2 and 3, Fig 5: 1, backboard; 2, stop-board; 3, ruler. Next get three stop knobs and rods, these rods are $\frac{1}{2}$ inch in diameter and 5 inches long, put a cloth washer on the rod close to the knobs. Bore three holes in the ruler, 6 inches apart, just above the stopboard, also in the backboard, line these with cloth, put rods in the holes, the middle one is for the coupler, the other two are for the forte shutters; make a slot in the stopboard under the middle stop rod, large enough for bent end of coupler rod to go through, this will be about $\frac{3}{4}$ inch long and $\frac{3}{8}$ inch wide, line with cloth.

See that this is made so that when the stop rod is finally fixed it will press the wire lightly to the

FIG. 2.—BACK END OF COUPLER WIRE.—FULL SIZE.

FIG. 3.—BLOCK.—FULL SIZE. A, Block; B, Screw; C, Cloth; D, Wire.

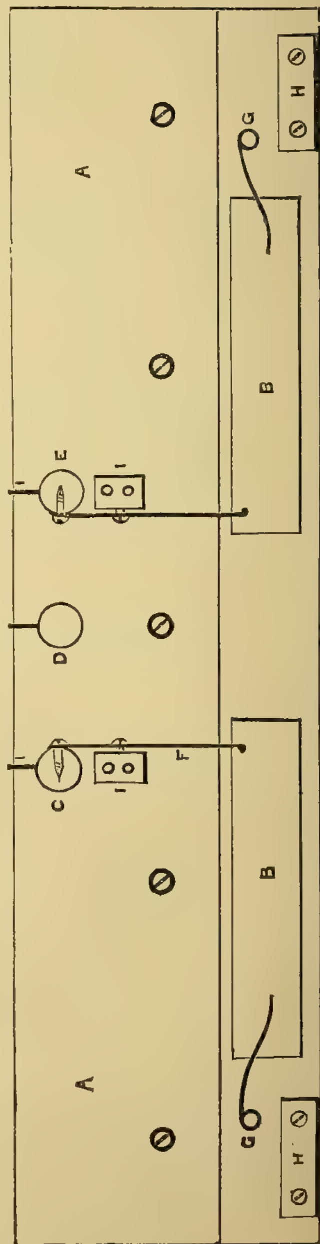


FIG. 6.—DIAGRAM EXHIBITING BACKBOARD AND ARRANGEMENT FOR ACTUATING SHUTTERS. Not to Scale.—A A, Backboard; C, D, E, Stop Rods; F, F, Shutter Rods; G, G, Springs; H, H, Hinges; J, J, Brackets to carry Cranks.

treble end of slot, Fig. 4 shows this. Make a wedge 1 inch long $\frac{3}{8}$ inch wide and $\frac{1}{4}$ inch thick, at front and $\frac{5}{8}$ inch thick at back, cut a piece out of the stop rod to bed this on, and fasten with small screws, so that when the stop knob is pushed home, the bent end of coupler rod just rests on the thin end. Figs. 4 and 5; make a wire staple 2 inches long, as K, Fig. 5, make a saw-cut in backboard just over middle of stop rod. See that stop knob is upright; bore two holes in it and fix staple so that it just enters the saw-cut, this keeps the stop rod from turning round.

I have omitted to mention that before fixing the wedge and staple, the backboard should be screwed through the cranks into the stop rods and they are done. You will now be able to play and to use all the stops, but the whole of the interior will want lowering. Press back the iron hooks at the back of the instrument, lift up the pan, pull it right over, and take out the screws that hold it in front, when you can take the pan, keys, and action away bodily. Turn the case up and disconnect the treadles; now take out the bellows and reservoir, and lower the blocks to which they are attached. You may have some little difficulty in finding out how they are fixed, but a little patient search will enable you to find out. After the blocks are lowered the required distance, 1 inch in this case, put the

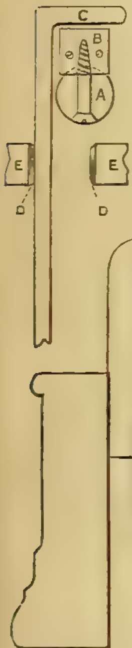


FIG. 4.—COUPLER ROD, ETC.—HALF SIZE.—A, Stop Rod; B, Wedge; C, Coupler Rod; D, D, Cloth in Slot; E, Stopboard.

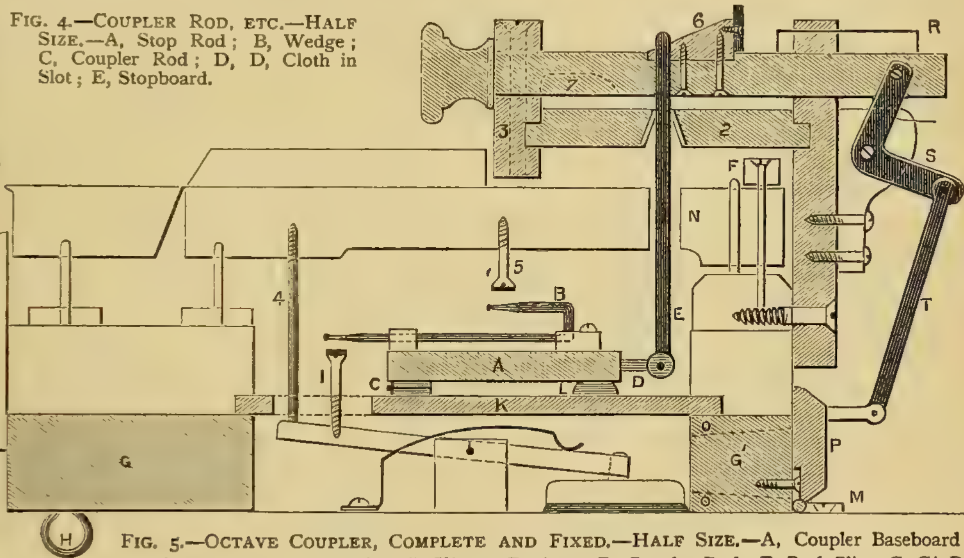


FIG. 5.—OCTAVE COUPLER, COMPLETE AND FIXED.—HALF SIZE.—A, Coupler Baseboard; B, Coupler Wire; B′, Blocks; C, Hinge; D, Arm; E, Coupler Rod; F, Back Slip; G, G′, Packing Pieces; H, Eye; I, Coupler Screw in Stem; K, Panel; L, Pad; M, Hinge; N, Hole in Key; O, Dotted Lines showing Hole in Back Rail; P, Shutter; R, Wire Guide; S, Crank; T, Shutter Rod; 1, Backboard; 2, Stopboard; 3, Ruler; 4, Touch Screw; 5, Coupler Screw; 6, Wedge; 7, Recess cut in under side of the Two Forte Stop Rods, so that when Stop is pulled forward and pressed down, it will not fly back.

to back rail of key frame, and the ruler to the key cheeks.

The octave coupler is now complete. There now remain the two forte stops, put them in their places and fix wire staples to prevent turning, as before; get two metal cranks, as S, Fig. 5, $1\frac{1}{4}$ inch long, bore a hole in the corner and one at the end of each arm; make two brackets to carry these and fix them to backboard, get two pieces of wire $2\frac{3}{4}$ inches long, flatten each end and bore holes in the flattened ends, get two more pieces 1 inch long, screw one end and flatten the other, bore holes in the flattened end and rivet loosely to long piece. Screw these, one into each shutter, and rivet the other end of long piece to its respective crank, push the stop knobs home and put a screw bellows back, connect the treadles, taking care to shorten the gut. Put on the pan, action, etc., and the job is finished.

I will now conclude with the hope that this paper will be of some use to those who are interested in this subject: I shall be happy to answer any queries, should anything be not quite clear.

I have omitted to mention that the two "forte" stop rods should have recesses cut in the under side. Each recess to be $\frac{3}{4}$ inch long by $\frac{1}{4}$ inch deep, and to commence at $\frac{1}{2}$ inch from stop rod. These are to prevent the stop from flying back when drawn. To use these stops, they must be drawn forward and pressed down; to release them, raise the knob and press home. See 7, Fig 5.

A WINDOW SCREEN IN BYSSOPHANIE.

By ALEXANDER MARTIN.

(*For Illustrations, see Folding Sheet issued with this Part.*)

A SUGGESTION was made by the author of the articles on "Byssophanie," in Vol. III. (or Parts 24, 25, 26), to the effect that this decoration would make a nice window screen. "The very thing our windows want," said I; so I made preparations for carrying out the suggestion, and I now propose giving the readers of "ours" my experiences therewith.

I puzzled myself over a design for some time, at last thinking the one illustrated would be the best I could fix on. I may say that our windows have three panes in the width; consequently, I have three compartments in the design, the two narrow upright blank spaces showing the position of the astragals of the window. The design, one-third full size, in imitation of a leaded glass screen, looked very well when finished, and the cost was little.

I first of all drew out the design full size on a sheet of paper; and I stupidly did not allow for the tracing-cloth expanding when I came to apply the paste to it, so that when I arrived at that stage, I found my design was too large. No other help for it, but to cut it down to suit. The cloth stretched in the damping about half an inch to the foot—that is, a piece 18 in. long by 12 in. wide, when quite dry, would be found to measure $18\frac{3}{4}$ in. by $12\frac{1}{2}$ in. when thoroughly damped. So allowance at this rate should be made when first setting out the design.

After getting my tracing-cloth the size I required—it cost about 10d.—I laid it, glazed side downwards (tracing-cloth is usually made with one side dull and the other glazed) on the drawing I had made, and traced in all the black bands, which represent leads, with Indian ink.

The way I performed this operation was as follows:—I took an ordinary drawing-pen, filled with the ink, and drew a strong line at each side of the band, and then with a fine brush—a camel hair one will do nicely—I filled up the space between the lines solidly with the black. In this way I got a nice, sharp, straight line everywhere. I used the ordinary stick of Indian ink, rubbed up in a little water until it was quite thick. When all the black bars were in, with the same brush I had been using I traced all the flowers and leaves in outline, letting the whole dry thoroughly before proceeding with the colouring.

At a stationer's I obtained four boxes of powder dyes, price 1d. each; the colours were yellow, crimson, blue and brown. I mixed up a small quantity of each, according to the instructions printed on every box: the yellow was used for the sunflowers in the horizontal border; crimson, for the flowers in the diamond and square centre panels; and yellow and blue mixed with a little touch of brown, formed a nice sober green for the leaves, altering the proportions of the colours for the different leaves in order to give variety. The band of strong colours separating the border from the main portion of the design is composed of crimson and blue alternately. But I would almost advise the omission of this band; for I somehow feel that it interferes with the general effect of the whole.

The brown dye is required to form, with the yellow, blue and crimson, the various tints for the greater part of the surface; and it is here that great taste must be exercised in selecting judicious contrasts, keeping, at the same time, all the colours quiet and unobtrusive. Better lay the tints on lightly at first, for if too light they can easily be darkened by spreading another wash of colour over; but you cannot take a wash off nearly so easily—in fact, it is scarcely possible at all. I left the groundwork, *i.e.*, the spaces between the flowers and leaves, and the nearest black band, quite untouched, as also a narrow strip round the lower portion of the design; this gives the dull white appearance of old glass, and is very effective.

When all was painted, my next move was to get it fixed to the window. I thought of pasting my screen on the inside of the glass; but an objection to that plan lay in the fact that it might too easily get soiled or damaged by being rubbed against; and washing would not quite do to clean it. So I got, at a glass merchant's, three panes of glass cut, so that they fitted neatly inside the astragals of the window. In measuring the size of the space into which a pane of glass is to fit, always give the glazier the size $\frac{1}{8}$ inch smaller each way: they seldom cut a pane of glass *exactly* correct; and by this plan, although they vary $\frac{1}{16}$ inch, there will be no trouble in getting it into its place. Having got the glass and tried them in, I pasted my screen to them and put them in, with the painted cloth *between* the two panes of glass; and a sprig at each of the top corners is sufficient to keep them from falling out. In cutting the painted cloth for pasting down on the glass, I took particular care to leave on each pane two little pieces on the top edge, about half an inch square. These are for getting the glass out after being put into the window, for a little experience will soon satisfactorily demonstrate that it is no easy thing to get the glass out from against the other pane if it is anything of a neat fit. But this plan of the two little flaps is just the very thing to obviate the difficulty; and if, as was in my case, the top of this screen comes in underneath an astragal, they (the flaps) lie underneath it, and are never seen except when they are looked for; the very

reverse of the usual custom of things—being in the way when not wanted, and never to be seen when they are specially desired.

My screen, therefore, can be taken out at a minute's notice, the only thing to do being to take out the two sprigs with a pair of pincers, and away it comes; and this is a great "desideratum."

In pasting the coloured tracing-cloth down on the glass, I used a paste made of flour stirred in cold water until it was all moistened; boiling water is then poured over it, stirring it all the time until it thickens, and becomes clear and transparent in the way starch does when treated in the same style. This paste I spread on the glazed side of the tracing-cloth, or the side opposite to that on which the drawing and colouring has been done. This is necessary, because if the paste were spread over the ink, the ink would become softened and spread over the surface, thereby spoiling the appearance. When all the surface was pasted over carefully, I got someone to help me to lay it properly on the sheet of glass. We took two corners each, and I let mine down on the glass first, letting the rest fall down gradually and gently. I spread a sheet of paper over it—any kind will do as long as it is clean—and gently rubbed from the *centre outwards*, until all the creases and air bubbles were out; these if left in would spoil it all, hence the necessity of doing this part thoroughly.

The three panes treated in this same fashion, as soon as they were dry, which took an hour or two, I sprigged in their places in the window; and, as I have already said, they looked exceedingly well.

The greatest fault in this kind of screen is that the colours fade when exposed long to the sunlight. After being in the window during the summer, and receiving the sun's rays after about twelve o'clock every day, all the colours, except yellow, faded considerably; so I took out the three movable panes and re-coloured the faded portions again. There was no necessity for taking the cloth off the glass, for no advantage was to be gained, and it would only entail more labour in pasting it on again. The colours do not seem to have faded much during the winter, probably owing to the sun's rays not being powerful enough to affect them; but even if they had to be renewed twice a year, it is not at all a troublesome operation.

The screen has this advantage over a real leaded glass one, that it has a splendid appearance viewed from either outside or inside—at any rate, by daylight. A leaded one looks miserably dull and uninteresting from the outside. By gas-light neither of them look well; but then the blinds and curtains are drawn, and one sees nothing of the window at all, so that it does not matter.

HOW I FURNISHED MY SNUGGERY.

Being Part III. of "My Furniture, and How I Made It."
By MARK MALLETT.

III.—MY WRITING TABLE.

A WRITING TABLE was also a thing of necessity in my Snuggery, and of the one which I made, I give a sketch in perspective in Fig. 23. I furnished it with a variety of conveniences, in the shape of pigeon-holes, drawers, and a gallery, as well as forming a comfortable knee-hole at which to sit. This table is 2 ft. 4 in. high—that is, to its proper top, the surface on which to write; its total height is 3 feet 4 inches, and the gallery is 3 feet from the floor. Its length is 3 feet 8 inches, and its width 2 feet.

The legs, of which I have given working drawings in Figs. 24 and 25, are of inch board $27\frac{1}{2}$ inches long by 4 inches wide. For the sake of greater symmetry and lightness, the lower ends of these legs are considerably cut down in width, this, however, being in the lower foot of their length only, does not unduly affect their strength. The front leg is reduced to 2 inches, half its original width; but the back which is less seen and which has in consequence of the superstructure of the table, a much greater weight to bear, is allowed to remain half-an-inch wider. The mortises at A, A, 2 inches long by $\frac{3}{4}$ of an inch wide, are to admit the tenons of the cross-pieces of the ends, one of which is shown on the larger scale in Fig. 26. At the upper, inner end of each leg a piece is cut away, as shown at B, Figs. 24 and 25, $4\frac{1}{2}$ inches long by $\frac{3}{4}$ wide, to receive the end of the cross-piece on which the table top is carried, and which is here shown in section. At C (same figure) is seen in section a strip of wood screwed to that last named, and which serves as a runner for the long drawer. The dotted lines at D, D, Figs. 24 and 25, show respectively the bottoms of the front and backboards, which come outside and are screwed upon the tops of the legs. Except at the splay, where a hollow chamfer is worked with the gouge, the edges of the legs are not bevelled off, but are only so far rounded with the file and sandpaper, as to give them a neat finish.

Fig. 26, as above mentioned, shows the cross-piece at end of table. The tenons at its extremities are let through the legs and pegged on their outer sides. This piece is of $\frac{3}{4}$ inch stuff, and is 4 inches wide. Its length from end to end is 25 inches; between the legs, from shoulder to shoulder that is, it measures $19\frac{1}{2}$ inches. The mortise shown in its middle, at E, is for the end of the longitudinal bar, Fig. 27, which connects it with its fellow cross-bar. This bar, Fig. 27, is a strip of $\frac{3}{4}$ inch board $36\frac{1}{2}$ inches long and 3 inches wide; from cross-piece to

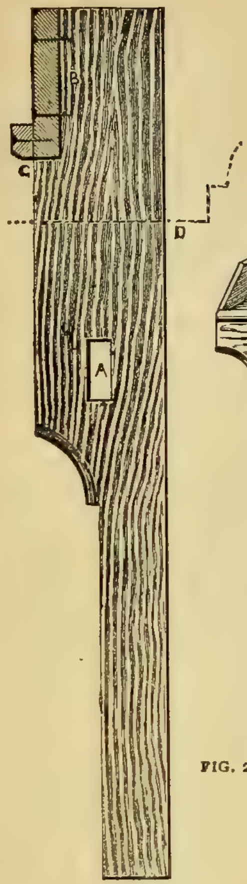


FIG. 24.—BACK LEG.

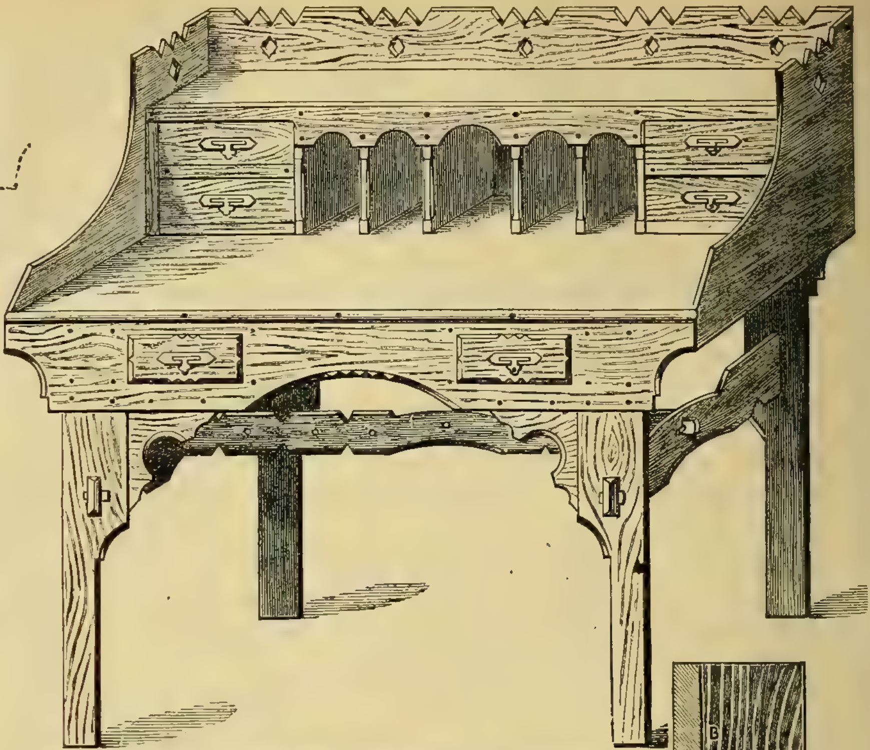


FIG. 23.—WRITING TABLE.

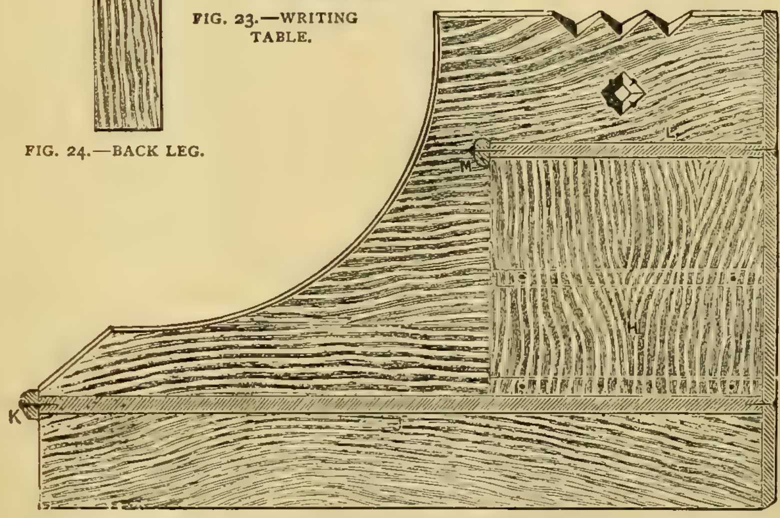


FIG. 31.—SIDE FROM WITHIN.

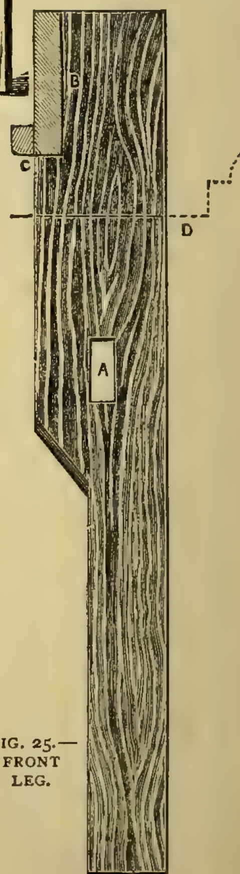


FIG. 25.—FRONT LEG.

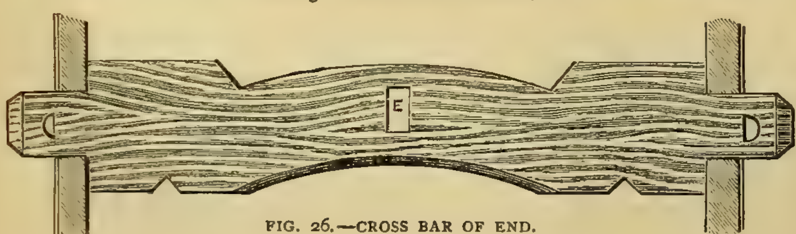


FIG. 26.—CROSS BAR OF END.

SSOPHANIE

RATED BY

WITHERBY & CO LITHO 325a HIGH HOLBORN LONDON. W.C.

A WINDOW SCREEN IN BYSSOPHANIE

Designed for "AMATEUR WORK" Illustrated By

ALEXANDER MARTIN

WARD, LOCK, AND CO., WARWICK HOUSE, SALISBURY SQUARE, LONDON E.C.

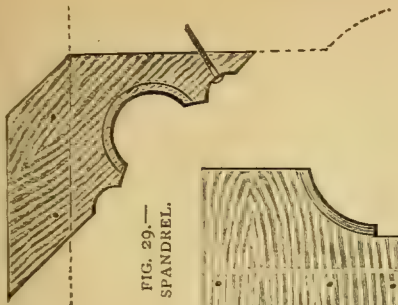


FIG. 29.—SPANDREL.

FIG. 27.—LONGITUDINAL BAR.

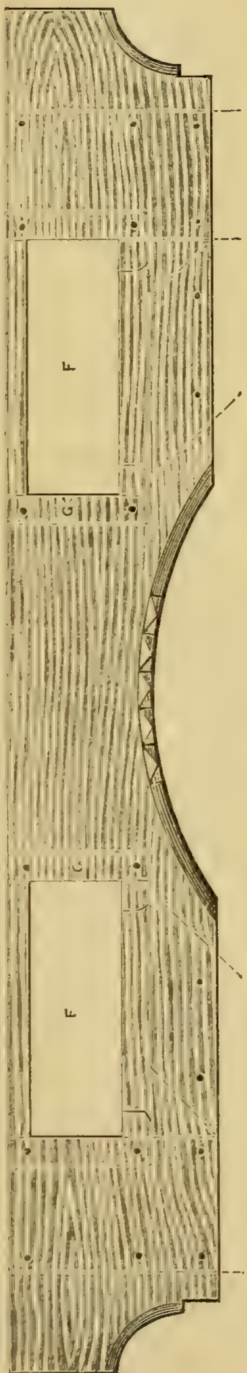


FIG. 28.—FRONT BOARD.

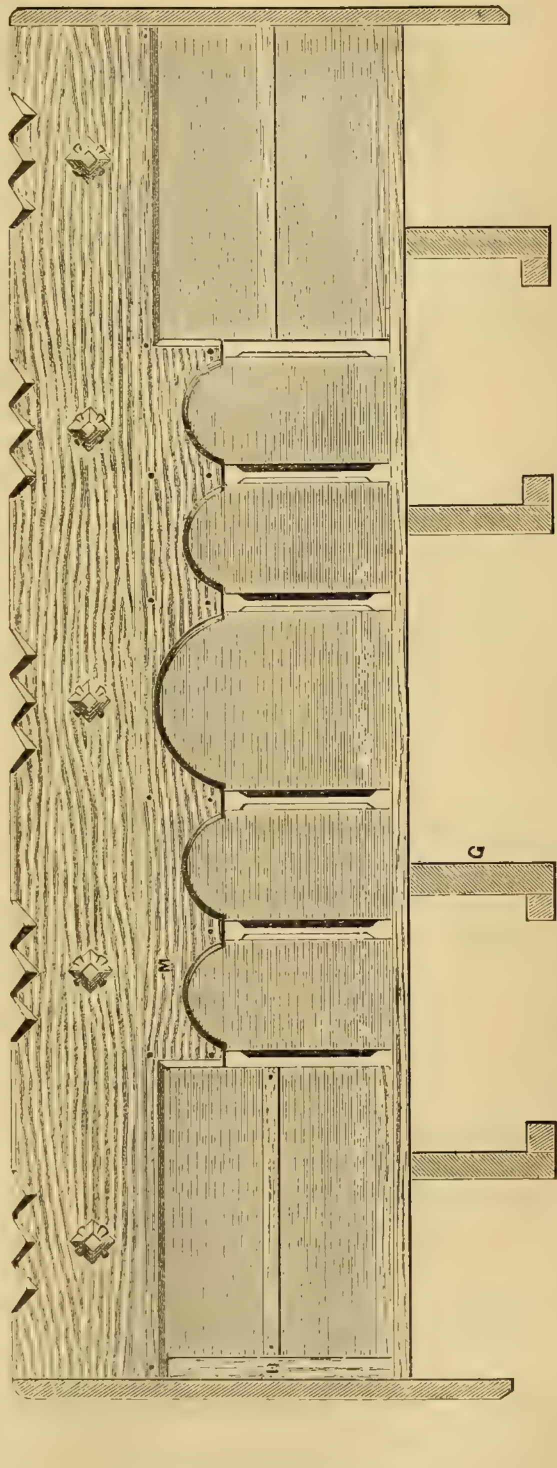


FIG. 30.—SECTION OF TABLE-TOP WITH ELEVATION OF SUPERSTRUCTURE.

cross-piece its measurement is 31½ inches. It is secured through the cross-pieces with pegs, thus drawing the frame-work tightly together.

Fig. 28 is the front-board; this is also of ¾ inch stuff and measures 3 feet 7 inches long by 6½ inches deep. The chamfer shown in the ornamental ends is rounded out with the gouge; as is also that in the knee-hole, which latter is, moreover, decorated with a little notched ornament. F, F, are openings cut 8 inches long by 3 inches deep, to receive the long drawers. The dotted lines show where the back of this board comes in contact with the legs, spandrels, ends of the cross-pieces, and runners of drawers. To the legs, spandrels, and cross-pieces, it is fixed, as shown, by large round-headed screws. For the better support of the two inner cross-pieces, G, G, a groove is sunk in the back of the board, a quarter of an inch deep, to receive their ends, though the runners attached to them are to some extent supported by the tops of the spandrels.

The back-board is in its general dimensions the same as the front-board, but it is without the knee-hole and the openings for drawers. The back ends of the cross-pieces, G, G, Figs. 28 and 30, are moreover let into mortises in the top of this board.

One of the spandrels which fill up the angles between the legs and front-board is figured at 29. It is of the same thickness as the legs, 1 inch, and should be cut from a strip of the same width, 4 inches. When fixed, it comes flush with the leg, to which it is screwed at its lower angle, as shown. Its upper end, like the leg, passes behind the front-board, to which it is fixed in the same manner with screws. As these spandrels beside being ornamental add considerably to the strength of the table, similar pieces (which are however plain) are used in contact with the back legs. To support the top of the table are employed those four cross-pieces, the ends of which are indicated in Fig. 28, and which are shown in section in Fig. 30. These are all of ¾ inch board, and are 4½ inches wide. The two outer ones are 21½ inches long, and the ends of these are as shown in Figs. 24 and 25, and simply screwed to the inner sides of the tops of the legs. The two inner pieces, G, G, are an inch longer that ¼ of an inch of their length may be allowed to enter the groove made in the back of the front-board, and ¾ of an inch may form a tenon to pass through a mortise in the back-board. The runners of the drawers which are, as may be seen, screwed to the bottoms of the cross-pieces in their inner sides, are ¾ of an inch square and 21½ inches long.

The frame-work of my table is now described, and we may proceed to its top, which is of half-inch boards. These are of course laid lengthwise, and screwed down to the four cross-pieces. The length of these boards is the same as that of the front and back-boards, with which they come flush, when fixed as well at the front and back as at the ends. The top is covered with American leather cloth, which is neatly fastened down along the front edge, as the strip of wood with which this edge is covered, is but a narrow one. At the ends and back the covering is a wide one, and less care is therefore needed.

Half-inch boarding is also used for the back and sides of the top. By referring to Figs. 30 and 31 it will be seen that the width of these pieces is 15½ inches, that for the back is of precisely the same length as the back-board and top—namely, 3 feet 7 inches. The ornamental details of its upper four inches are shown in Fig. 30. They are not such as cost much labour, but they nevertheless sufficiently serve to give lightness and relief. This board is in the first place secured by some four or five screws driven through it into the back-board, and finally by others driven into the uprights which support the gallery-board, and into that board itself, as well as by a couple of small round-headed ones, sent through the sides and into its upper corners.

The somewhat eccentric form of the sides will be seen from Fig. 31. Their width is the same as that of the back, and their length is 23½ inches. In Fig. 31 the side is shown from within; H represents that upright piece of wood which is also marked H in the elevation, Fig. 30, and of which the end only is there seen; and the dotted lines which cross it indicate the runners of the two short drawers; I is the back seen in sections; J is the table-top seen in the same manner; K is the narrow strip in front by which the cloth is secured on that side; L is the board which covers over the drawers and pigeon-holes and forms the gallery; and M is the strip which runs along the front of the gallery, and of which a front view, marked by the same letter, is to be seen in Fig. 30.

The upright pieces, H, H, Figs. 30 and 31, are 7½ inches high by 8½ inches wide, and are of three-quarter inch board. The other six uprights, which form the partings between the pigeon-holes and divide the latter from the drawers, are of the same superficial dimensions, but are only half-an-inch thick. The two end-pieces, H, H, are thicker, because it is to them that the back and sides have to be screwed; in fact, the strength of the superstructure is to a great measure dependent upon them. The centre pigeon-hole is 5½ inches wide, the others 3½ inches.

The board which covers these uprights, and forms the floor of the gallery, is seen in section in Fig. 31, and marked L. It is of ½ inch stuff, and has like the table-top to be covered with American leather-cloth.

The strip in front of the gallery, M, Figs. 30 and 31, is also shown as of ½ inch wood. It is cut to the

form of the arcade, as seen in Fig. 30, and screwed in place with round-headed screws. I used ½ inch wood, as drawn, for both these last pieces, but ¼ inch would have looked neater and done equally well, as little strength is required in them.

The narrow strip which runs along the front of the table-top proper, K, Fig. 31, is ½ inch thick by ¾ inch deep. It covers the edge of the leather-cloth, and gives a finish to the front of the table. It is rounded off as shown in the sections, and is attached to the table with small round-headed screws.

The drawers only remain unnoticed. The two lower and longer of these are to within half an inch equal in length to the width of the table, for they have false fronts screwed over their real ones, which project half an inch before the front-board, and they therefore come flush with the strip just mentioned. These false fronts will be seen to have a little notched ornament. For the ends and sides of these drawers I used ½ inch board, and ¼ inch for their bottoms. For the four upper drawers, which are only 8½ inches long, I used ½ inch board for the sides and ¼ inch for the ends and bottoms.

The perspective sketch of My Writing Table (Fig. 23) is not drawn to any exact scale, but it nearly approaches 1 in.; the other diagrams are on a 2 in. scale.

(*To be continued.*)

PATTERN MAKING FOR AMATEURS.

By A. J. SCOTT.

VII.—WHOLE PATTERN OF ROPE PULLEY—HANDY WAYS OF SETTING WORK OUT IN CURVES, ETC.

HAVING in my last article promised to describe the making of a whole or full size pattern, I herewith fulfil my promise, and append some very handy ways of getting curved lines and dividing the circumference of a circle into any required number of parts. The latter, I believe, has been published once before, but it is some years ago, and it was in the *English Mechanic*, I believe I saw a method on the same principle, but it really is so useful that it is worth committing to memory not only for pattern makers (amateur), but all our readers generally. Really the main spring, if I may so term it of it is the following; on the supposition you have only one sixth of the circumference to work upon.

We will suppose the circle is required to be divided into nine equal parts, and to get a ninth, we simply divide the sixth by nine and take six, and for ten equal parts, divide by ten and take six, but more anon when I come to prove my statements.

In regard to the first item, a full size pattern groove pulley, we will suppose that more than one groove is required, for a method of making a full size single groove pulley, has already been described in a previous article. The one under consideration is one which is generally termed a plated wheel, owing to one continuous plate instead of or over the arms, in this case being the latter. We find on referring to the section, Fig. 106, the exact outline of the arms required, which in this case, three would be sufficient.

In commencing to make a pulley of this description, it is always best to make a full size drawing on a board, to work to till the work is completed, by doing so, you have all the centres almost as it were set out for you; for by laying your trammels or compasses to these centres, you may transfer them to the work on hand, direct without any countermeasuring whatever, so I will infer you have made a drawing of, at least one view, that is of a longitudinal section through the pulley, which in this case would almost be sufficient for the purpose required, and the next thing you would require would be a good face-plate for your lathe, and "*balanced.*"

I wish here to say a few words regarding lathe jumping or chattering, one of the most evil things that could happen to a lathe. Some will jump and vibrate, because they have never been set level, others from bad fitting and turning in their working parts, but I believe that most lathes which are troubled with this affliction, derive it from an unbalanced face-plate; the reason is obvious, most face-plates are only turned on one face the other side being left unturned, is very often unequally balanced, sometimes also it is found necessary to enlarge the iron face-plate, by a wooden one attached to it, and through perhaps of the gravity of the wood being unequal, you get an unbalanced face-plate, it is very easy to see how this defection would make your lathe waddle or jump, as the centrifugal force which the heavy side would gather, would also tend, as it were, to jump away from the face-plate, and make the headstock vibrate and jump. Amateurs must excuse me putting this matter in such a simple way, but I myself always prefer practical knowledge to theoretical, hence the simple way of putting it. What we want, as workmen and amateurs, is not a lot of algebraical problems, but the why and the wherefore of what we wish to know in as simple and as practical a manner as it is possible to put it.

The following remarks on lathe chattering are taken from the "Engineer and Building Trades Almanack," and shows what are the writer's ideas on the subject. "It is stated that if the spindle of the lathe were as large as the ordinary face-plate upon it, any work done in such a lathe would, all other things being equal, undoubtedly be free from inequalities or

chattering. Particularly would this be the case where castings are faced off, such as cylinder heads, etc.

"The reverse of this statement is true. If a lathe of, say 20 in. swing, had a spindle of only 1 in. diameter, it would spring and chatter greatly. Now where lies the mean between the two? A large spindle is undoubtedly of great advantage, for it obviously brings the point of support further from the centre, but how large should it be for a lathe of a given swing?

"As now constructed, these details vary with the views of builders, but it seems to us there is or should be a fixed size. The only objection we see to a lathe with a large spindle, is that in case it is not perfectly adjusted, it will require more power to drive it; but this is no argument against a large spindle, for we might say similarly if the boxes were screwed down too tight on the spindle, the lathe would run hard. One statement is just as correct as the other. An argument for the importance of a solid bearing at the front end of spindle, is shown by the practice of all the lathe men of experience, who, when they have a flanged casting to face off, put a brace between it and the dead centre, slacking off the end screw first, so that the spindle collar bears on the box or brasses, the work runs steadily then, when without the brace it would have chattered.

"The cause of chattering, so chronic in many lathes, is, in our view, owing to small spindles badly fitted, and is so easily remedied, as regards the fitting at any rate, that there is no occasion for it."

I will now refer our amateur to the pulley under consideration, shown in section at Fig. 106, and the method of construction in Figs. 107 and 108.

For construction, by referring to Fig. 107, you will find an elevation of the pulley pattern, complete on the face-plate of lathe, C being the ordinary iron face-plate, and D a wooden one, firmly secured to the iron one by either bolts or screws; in this case bolts are shown at E, whose heads are well countersunk into the wooden plate D; to commence work on the pulley proper you will want one segment of each layer cutting first, to do this, you will require to set out with trammels or compasses, one-fourth or one-sixth just as you intend to cut the segments.

I must leave this to our amateur's own discretion, as I can make no hard and fast law on the number of segments to use. All this depends on—first, the thickness of stuff; second, radius of curve; and, third, the kind of timber you are using. In regard to the first, you will require that the thickness of the groove pitch, shown a little more clearer in Fig. 106, where C represents the centre of one groove, and D another, the shortest straight line that can be drawn between these two centres represents the pitch: this will be the thickness of your timber, for the second item, viz., radius of curve; this will depend on your requirements. The one drawn is about 24 inch centres for the large speed and diminishing to 11 inch centres at the smallest, perhaps the best number of segments in this case would be six for the larger and four for the smaller diameters; in regard to the third, the kind of timber you are using, it will perhaps be more economical to use a greater or lesser number of segments, owing to your wood being too shaky or knotty to cut up, economically, into the ordinary numbers. This being decided, the number of segments and the thickness to cut them, we will commence with the first piece screwed on the face-plate, namely, the one marked B in Fig. 106.

This is all in one and not in segments, as the other layers, and it will want screwing to the face-plate from the back: instead of screwing you may sprig the piece to the face-plate with wrought sprigs, not forgetting to first cut off the heads so as to be able to draw them out from the other side; the other layers are simply glued and sprigged, as shown at A, A, A, A, Fig. 107; and after having faced up the piece, B, to the thickness, you may turn a few grooves on the joint face, to catch the dirt and other impurities in the glue, this is shown more fully in Fig. 116; you afterwards treat the other layers in the same way, the outside diameters of increasing size you can finish as you proceed. For the inside you had better make a thin wooden templet of the shape of B, B, B, B, in Fig. 106, rubbing the rim edge of templet with chalk. The tools you will turn the inner edge of rim by, will be a gouge to rough it out, about the section shown in Fig. 117, a round nose like Fig. 118, and an ordinary flat scraping chisel. It will be superfluous on my part giving more particulars over these tools, as full instructions have already been given in previous articles on the subject.

The reason I advise turning the outside edges square is on account of the moulding, for if the amateur requires only one casting, it will be cheaper and easier to make it as per sketch than to core out the grooves, as would have to be done if a quantity was required; but when only one is wanted, it will be best to turn the grooves out in the casting.

The next thing to consider is the arms and boss; if I were a moulder I would prefer having these loose, and I think the amateur had better leave them so, as they are handier to draw out of the sand, when detached from the rim. To enable the boss to keep always true in the centre and the arms one distance, you will require a pin on one end of boss fitting into a hole which has been turned in centre of pattern, shown more fully in Fig. 114, A being the boss and B the pattern; to fasten the arms secure to boss, you will cut three slots in a perpendicular direction, the width of slots being equal to the thickness of your arms which will be glued in these slots and afterwards

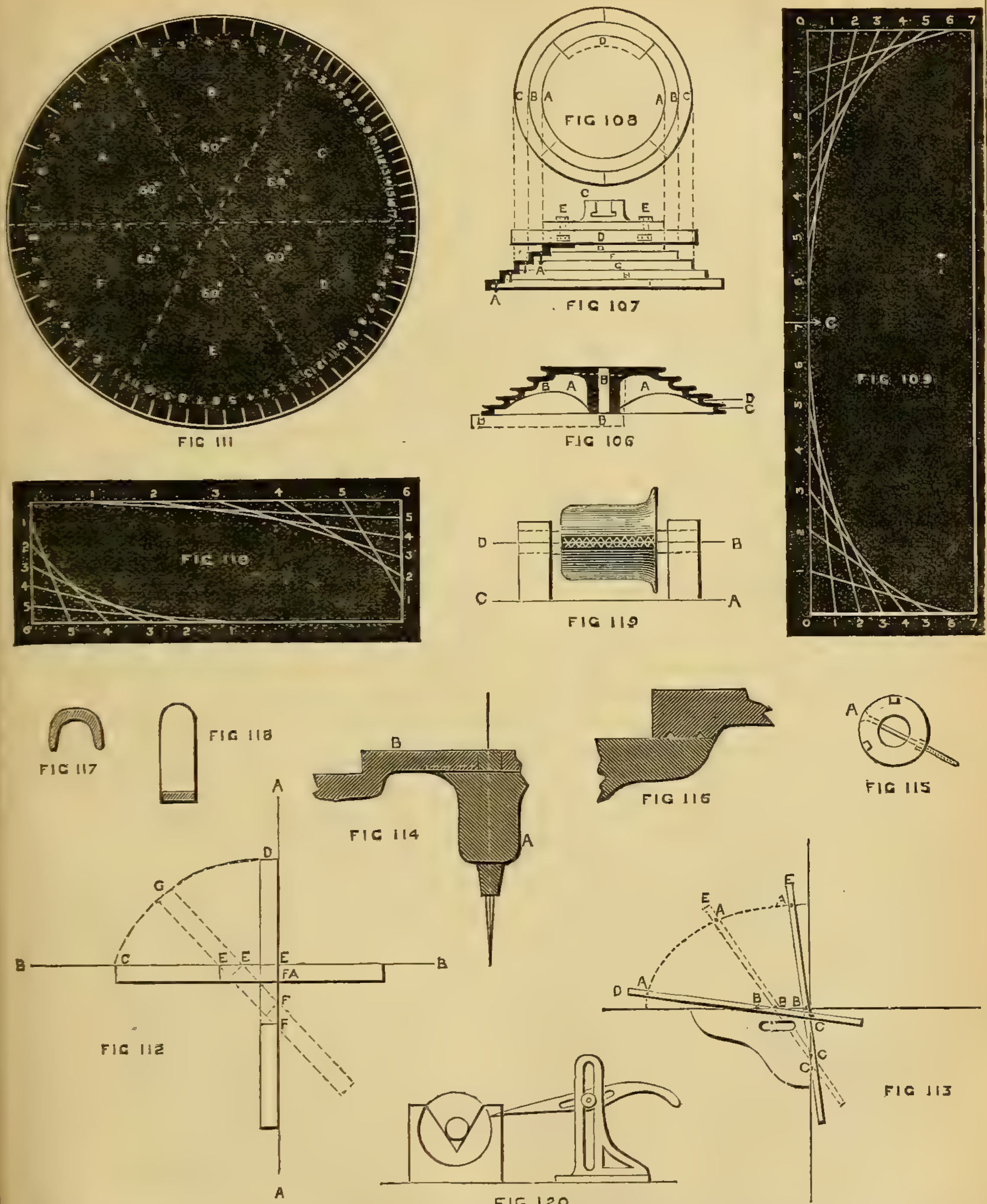


FIG. 106.—SECTION OF DRIVING SPEED ROPE PULLEY. FIG. 107.—PATTERN OF DITTO, FASTENED ON LATHE CHUCK. FIG. 108.—PLAN OF DITTO, SHOWING SEGMENTS. FIGS. 109, 110.—METHOD OF SETTING OUT CURVES. FIG. 111.—METHOD OF DIVIDING CIRCUMFERENCE INTO ANY GIVEN NUMBER OF PARTS, ONE-SIXTH PART OF CIRCUMFERENCE ONLY BEING GIVEN. FIGS. 112, 113.—HANDY PRACTICAL OPERATIONS IN DESCRIBING AN ELLIPSE. FIGS. 114, 115, 116.—DETAILS OF PULLEY. FIGS. 117, 118.—TURNING TOOLS FOR DITTO. FIGS. 119, 120.—SETTING OUT OF PULLEY BOSS.

screwed from the opposite side of boss, shown at A, Fig. 115. The method of setting out these slots will be to mount the boss in a horizontal direction on two V blocks, as shown in Figs. 119 and 120, and drawing by a scribing block, taking care however that the centre from A to B is equal to C D, Fig. 119; for the arms, you will not forget to leave a little strip (taper) in them as they will leave the sand so much better, nothing now remains to be explained but the core for the centre. If this is of a very small bore, it would be better to leave it solid; but in any case leave the core plenty small enough for boring, as it might get twisted in the casting and then not afterwards be able to clear up. In cutting the arms out to shape, use your turning templet to mark them out, and then one will coincide with the other, allowing your distance which you have let them into the boss.

I will now explain the setting out of curves shown in Figs. 109 and 110; they are drawn to the sizes given which can be reduced or enlarged, and altered to suit individual wants; Fig. 109 represents a semi-oval of 7 inches by 2, drawn full size for better explanation. The reader will notice, in this instance, that the curve is really only 3½ inches by 2, and to strike this out, in a very simple and easy way, which is quick as well, I recommend the following:—

Set the size of oval out in a rectangle and at the right angles thus drawn, to the centre in either direction set out an equal number of parts, draw intersecting lines, and the points of intersection or rather the centre between them, will give the outline of the oval required. To apply this rule to the sizes under consideration, we first of all describe a rectangle 7 by 2, but as we only want a semi or half-oval, we can use one of the lines drawn as a centre of the oval in one direction; it is much easier in dividing to take half-inches, quarter-inches, and so on, if possible, so in this case for the 3½ inches, we take seven parts and set out accordingly; but as there are 8 quarter inches in 2 whole ones, and we only want seven parts, we are forced to divide equally in this case. After having divided, we draw intersecting lines from the minimum number to the maximum, as from 1 to 6, then the minimum number to the next maximum number, as 2 to 5, and so on, until all is drawn: you will now readily see how an oval can be described by filling up the corners as shown at A, A, Fig. 109. At Fig. 110 is a very handy curve templet, for all kind of work which you may be doing where there are any elliptical curves required in the making. The one here shown represents two different curves of the sizes given, and it will be found handy to have several of these templets by you of different sizes as they come in so useful in such a many ways, the method of procedure in setting out is precisely same as the one previously described.

There are still two more ways of setting out ovals to which I want to draw my reader's notice; of course I cannot say they are accuracy itself, but I believe they will describe almost as true an oval as most of the faddy articles that are now in the market for the purpose, and their cost is *nil*, plus a little labour, so I think we shall have an advantage in trying if not adopting the methods I shall here explain. The first is rather what I may term a crude method, suitable where great accuracy is not wanted or required. You simply draw two centre lines at right angles to each other, as shown in Fig. 112, F, A being the common centre, you then take a strip of wood, shown at C, D and G, and at one end you fasten a blacklead, or hold one there; and from this same end you scribe on the edge of strip each of the centres, their distance from F, A. Now to draw the oval; you first lay the strip with the scribed edge to the line B B, and then slowly move the strip till you get to G, having kept the two scribed centres E and F always on the two lines first drawn at right angles; you still continue to move strip till you get to D, when you will find you have drawn a quartern oval, do the same to the other quarters, and your oval will be complete. This method looks on paper a long and clumsy method, but a little practice in describing these ovals will soon enable our amateur to draw one very true, and also very quick, far quicker than I can describe it or have done so.

There is a much truer and I might say a much better way shown in Fig. 113, but really it is only a variation of the one previously described, the chief difference being, you are provided with a set square for a guide; instead of guiding the strip centres over the centre lines, the method of procedure being in this case to keep a set square close to the centre lines you first describe, and afterwards to make a strip of sufficient length to take the three centres A, B, C, Fig. 113. The shortest centre is the distance from A to B, and the longest from A to C; at the centre A, which describes the circumference, you will require a hole, making to fit an ordinary blacklead tight so as to hold it in a fixed position, at the other two centres B and C, you will merely put a fine brad through to enable it to move the right distance over the set square; D, E, F shows the various positions the strip will take in describing the circumference. In this, as in all other problems or operations, it is always best to work to centre lines, by so doing you only save yourself confusion and vexation at a later stage of your work.

At the beginning part of this article, I mentioned a method of dividing a circle into any given number of equal parts, which method is shown more fully in Fig. 111. At first sight of this figure, you will perceive

it is divided into six equal parts, and as we know by geometry that a circle contains 360°, we may infer from this that each of these sixth parts contain 60°, being one-sixth of 360°, now each part is subdivided in more parts still, some of them containing a great number of parts. Now the knowledge we wish to acquire is to get the exact division of the circumference we wish for, from only one-sixth part of the circle, and it very often happens that we want a fifth, or seventh, or some other division, awkward to get, and we have not the space either at command to set out the whole circle to get the exact division.

I do not here state that the method here recommended is *theoretically exact*, but I will say that it is exact enough for all practical purposes: the *modus operandi* to be followed is to divide the sixth into the same number of parts which you require of the circumference, then take six of these parts, which will be the length of arc you require; in the case of a fifth you divide the sixth into five and then add another to the sixth, which altogether will make a fifth part of the circumference ; this is shown more fully at A, Fig. 111, whose 60° is divided into five, the other being added in the part B, denoted on the outside of circumference. To prove this statement we must find out what number of degrees there are in each of our fifth parts ; having proved there are 60° in the sixth of circumference, it follows we must have 12° in each of our fifth parts, and by adding one more part to them, we get $60 \times 12 = 72$ so really we have 72° in the fifth part of circumference. Now let us see whether five times this amount will make up the number of degrees in the circle, 360°; so in a simple multiplication sum we find $72 \times 5 = 360$, which is the amount required, and also proving our method of procedure correct in practice.

The other divisions follow the same law ; so for the sake of making all perfectly clear, I will briefly describe the other divisions. The next in order follows B, which requires to be one-seventh part of the circumference ; we take six of these parts, which will give one-seventh of circumference. To prove this, as before, we have 60° to commence with, but in this instance we shall get into fractions if we take 360° as the number of parts, and as I wish to avoid all arithmetical computations as much as possible, I shall only just give a simple way of proving, rather rough but accurate : the number of parts wanted being seven, and the one given being a sixth, it follows that six sevens will come to the same result as seven sixes. The next division, C, shows a very curious division, namely 17 equal parts ; it is very improbable that our readers will ever want this division, but it will serve to explain more lucidly, perhaps, the one he might require; the other divisions D, E, and F, follow the same rule as the preceding division, namely, to take six parts out of the number divided, which will represent the divisional part of the circumference which you require ; D would show a circle divided into 13 equal parts ; E, one into 11 equal parts ; and F into 8 equal parts in this last, as in any of the others, we have 60° in the whole division, but in each eighth part we only have 7·5°. Now if we take six of these parts, the sum total would be $7{\cdot}5 \times 6 = 45{\cdot}0$, or 45°, and our circle or circumference being required in eight divisions it follows that $45° \times 8 = 360°$, proving our method also correct in this case as the others. I do not think any amateur will find any difficulty from this rule, to obtain any number of divisions he may require ; but some of our theoretical friends may not give the rule a good name, but that will not do it any harm. What we want, as amateurs and workmen, is sound practical rules which shall come into everyday use, and add to our store of knowledge already acquired on the subject; of course, in many instances we cannot do without theoretical knowledge, but this comes in most useful when it is combined with practical ideas, hence the need and urgent necessity for technical education.

(*To be continued.*)

ELIZABETHAN FURNITURE.

WITH PRACTICAL HINTS FOR ITS CONSTRUCTION.

By Rev. ALGERNON THOROLD, M.A.

III. — THE USES OF OLD BEDSTEADS — WARDOUR STREET OAK.

IT sounds rather like a joke to be asked whether an old bedstead will be of any use to one, especially if it is a wooden one and all to pieces ; but if you are mechanically inclined, or perhaps it would be better to say, if you are something of a carpenter, do not hurriedly reply, "Oh, dear, no, thank you," but go and look at it. It may be really an old bedstead; it may be not so much antiquated as antique; it may be not as our imagination vividly pictured it at first—a mahogany abomination, but a veritable find, in the shape of an Elizabethan or Jacobean four-poster, of sterling heart of oak.

These are becoming rarer every day, and when heard of are to be snapped up at once. Whether one would like to sleep in them is another matter. It would, I think, require a great amount of courage to face such an enclosure as we saw last year in Old London at the Healtheries; and we might be inclined to prefer the sofa to the fine old Gothic bedstead by Pugin, shown in Fig. 4.

The old-schoolmen used to puzzle each other with

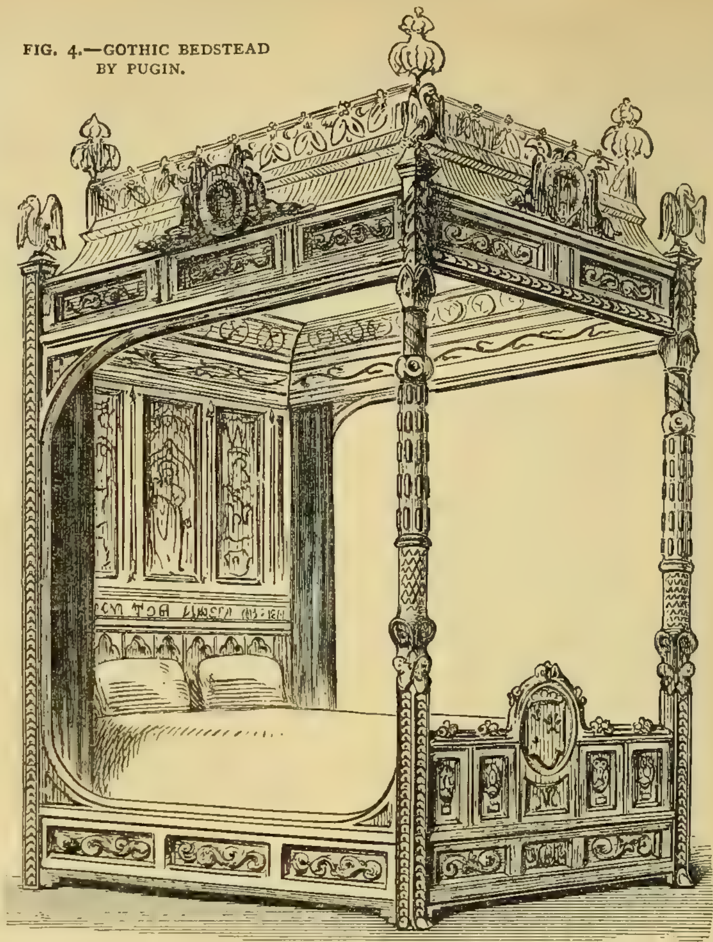
the question, "How many angels could dance on the point of a needle;" but while they doubted whether one or one hundred thousand was the right answer, we, at all events, would feel sure that at least a few dozen Tudor, Elizabethan, Jacobite and Hanoverian ghosts must struggle every night for possession of such a bed as this.

However, no such old bedsteads as the above are very likely to be offered as a gift, or for any moderate consideration in money; and even if they were, we should soon want a pantechnicon for their storage. One, might be a curiosity and a valuable addition to a haunted room; but more would soon pall upon the appetite of all but the most enthusiastic lover of bedsteads. I mean if they were kept as bedsteads, for we should soon reduce our friends' love for our company if we expected them to retire into these wooden apartments whenever we asked them to spend a few days with us in our old country house.

I remember being shown the house of a collector of old oak, and hearing that he had just completed the purchase of the final Jacobean bedstead, which was to complete the set, there being now one in each bedroom.

His poor wife, I believe, was thereby

FIG. 4.—GOTHIC BEDSTEAD BY PUGIN.



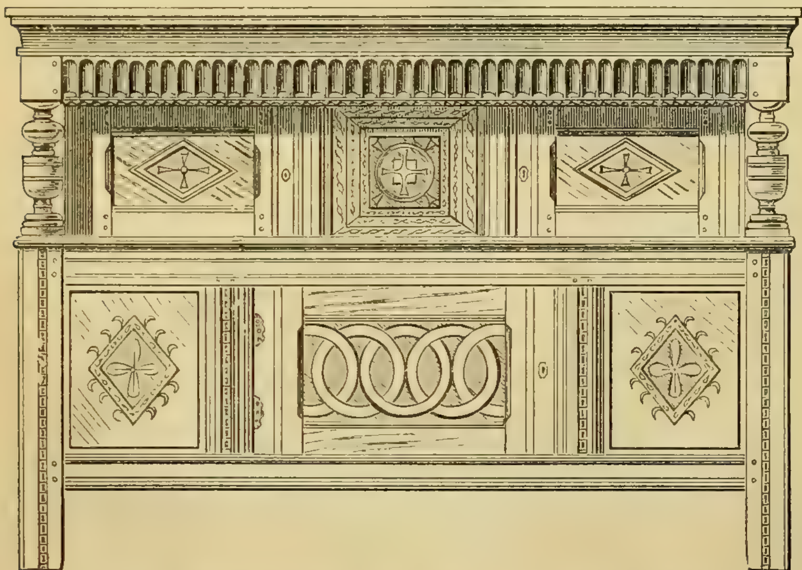


FIG. 5.—CABINET OF PIECES OF OLD CARVED OAK—FRONT ELEVATION.

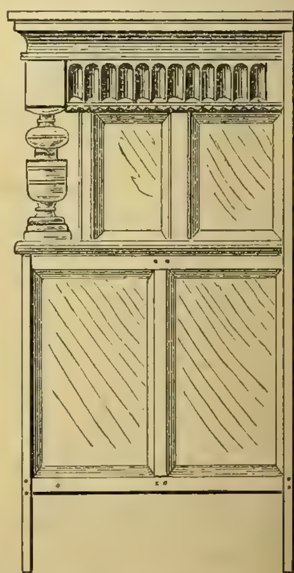


FIG. 6.—SIDE OR END ELEVATION.

reduced to despair, but was heard to say that although her husband spent everything he could on old oak, she hoped some day to clear all the rubbishing old bedsteads and things out again.

If any of my readers happen to be overburdened with bedsteads like this good lady, I think I can help them to get rid of them in a very satisfactory way.

I demolished a portion of one myself not long ago, and under the magician's wand of bench and tools, transformed it into a fine old cabinet, which looked like the genuine work of two hundred and fifty years ago, as shown in Fig. 1, for which the reader is referred to page 269. Illustrations of this cabinet are given in Figs. 5 and 6, the former showing the front elevation, and the latter the side or end elevation.

There is nothing pleasanter to the eye in any room than some really good old oak. I do not mean vast and uncouth book-

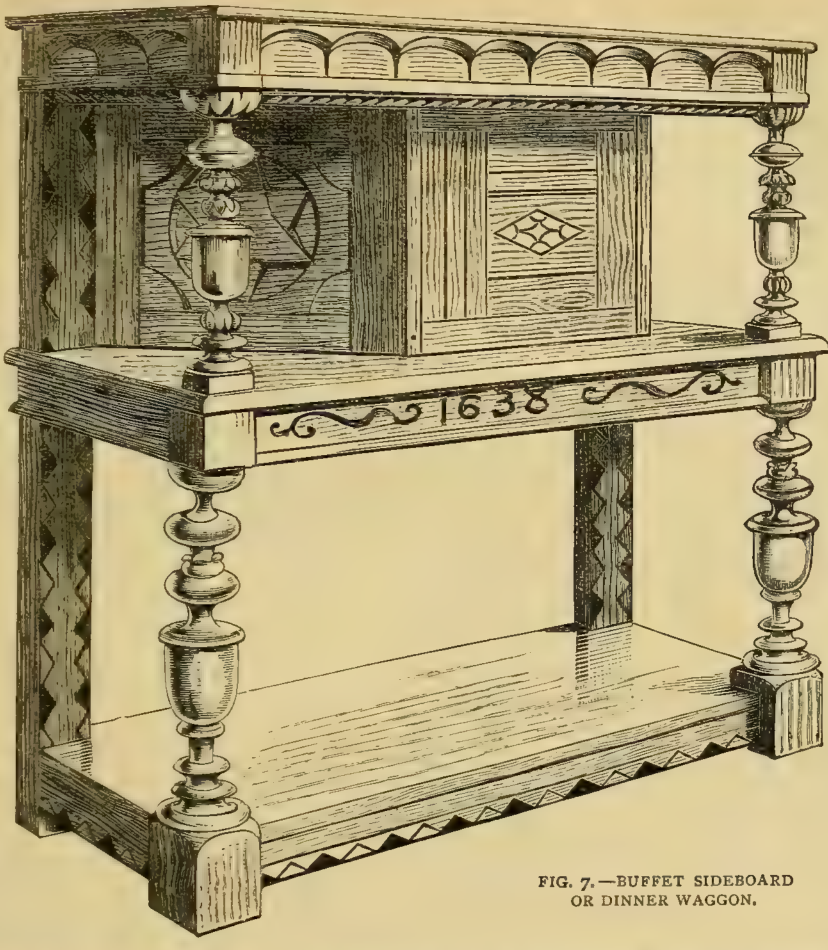


FIG. 7.—BUFFET SIDEBOARD OR DINNER WAGGON.

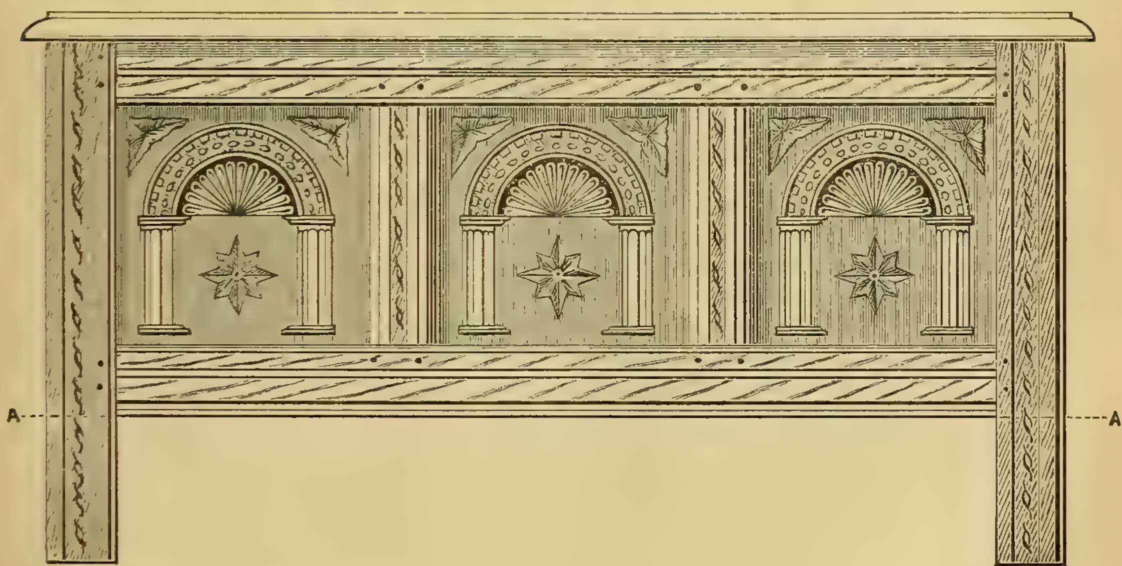


FIG. 8.—FINELY CARVED OAK CHEST.

cases covered with colossal fruit, nor gigantic sideboards bristling with foxes' heads, suggesting the idea that the animal is really in the cupboard, and in trying to break through the door has stuck fast; or, if there is no fox, yet protuberant with pheasants and partridges, hares and rabbits, making one think that the sporting master of the house has just hung up the spoils of the day—but I mean quiet, sober old cabinets, like that which is exhibited in Fig. 1. Tiny buffets, such as we now call dinner waggons, Fig. 7, or finely-carved chests made of English oak, with plenty of flowers and silver thread in them, as shown in Fig. 8, respecting both of which we shall have something more to say.

These specimen pieces furnish a room in themselves, especially if our resources and taste can command some "old blue" to harmonize with, and yet relieve the sombre oak.

If you should have a taste for old oak, and do something already in the way of making up old pieces, do not be tempted to invent your own designs, or your oak will certainly be found out, and some day you will hear a critical friend call it *Wardour Street* oak.

There are, I have no doubt, plenty of "original" pieces in that locality, and if you have the eye, the purse, and the courage to pit yourself against the dealers, you may pick up a treasure there now and again; but if you have any oak which can be made up, go to work on old lines and upon old designs. If you carve, don't introduce flowers and birds after the Swiss style, but stick to the rigid-looking antediluvian thoughts expressed in what carving you already have before you.

There is no necessity to introduce rough work, under the impression that the rougher it is the older it looks, for this is a mistake. Much of the old work, doubtless, was rough—there is no question about it—but still much was quite the reverse, and charms the eye by the softness and beauty of both the design and workmanship.

In these days of cheap work, and the imported productions of American machinery, we may look in vain for the delicate mouldings and beautiful combination of hollows and flats shown on many a humble chest of two hundred years ago; and there is no doubt that the workman of the past had a thorough knowledge of effect and a keen appreciation of lights and shadows, otherwise his work would not now be a study—indeed, and judging from it, every village carpenter of the Tudor and Elizabethan times must have been an artist with pencil as well as with chisel.

Another mistake is also often fallen into—Old oak it is thought must be black. Black old oak has rather an imposing sound about it, but oak, however old, is rarely black in grain. Dirt and smoke, soaked in with beeswax and turpentine, have in many cases given a coat of black, which varies in thickness, but which soon comes off under the persuasion of ley and "black soap." The beauty of genuine old oak is not its blackness, but its rich brown colour, in which the silver flower and grain of the wood is clearly visible.

Wardour Street oak is as dark as a coal; indeed it generally looks as though it had been carefully blackleaded and polished with a brush, like the bars of a grate. Consequently, it is heavy-looking, inartistic, hence ugly.

Often the unlearned in old oak lore think nothing of a genuine piece, because the colour does not seem "right." It does not look old, they think, if the grain of the wood is to be seen. That is why dealer's old oak always appears as though it were covered with solidified treacle.

(*To be continued.*)

THE MAGIC LANTERN:

HOW TO MAKE IT AND USE IT.

By A PRACTISED HAND.

VII.—Rackwork Slides (*continued*)—The Eidotrope—The Kaleidotrope—The Smoke Effect—The Four Seasons Effect—The Snow Effect—Moonlight Effect—The Storm Effect—The Lightning Slide—The Rainbow Effect—The Fountain Effect—The Cascade Effect—Chemical Experiments—Galvanic Experiments—Electro-Magnetic Experiments—Conclusion.

OTHER EFFECTS PRODUCED BY MEANS OF RACKWORK SLIDES.—A great variety of effects may be produced with the rack and pinion arrangement described in my last paper. For instance, if we cut out discs of perforated zinc and rotate them in opposite directions, some remarkable designs will be projected on to the screen. If they are covered with coloured gelatine films, the designs will be tinted. Crape, or muslin dyed black and gummed to the glass discs, produce curious effects, also pieces of black lace, skeleton leaves arranged like the spokes of a wheel, mosquito netting, etc. One of the many chromatic effects can be shown by getting two opaque discs (or stopping out the glass discs with black paper), and making three small round holes in them, so that when put together they will exactly coincide, Fig. 62. Over each hole you must gum a piece of coloured gelatine, using the three primary colours; the three holes would then show red, blue, and yellow on the screen, but

when put into the rackwork frame and made to rotate slowly in opposite directions, where the different films overlap, we shall see on the screen the three secondary colours—green, orange, and purple. This is a pretty experiment, but we sometimes fail to get the green, which is owing to the blue not being a perfectly pure colour, in which case, of course, we must change it until we get exactly the right blue.

The Eidotrope is a very surprising effect, also shown by means of the rackwork slide. It consists of two opaque discs of japanned tin or blackened cardboard, in which a series of concentric holes have been punched. When these discs are made to rotate slowly in opposite directions, all sorts of geometrical figures are formed on the screen ; when they are turned quickly, scintillations of light, meteor-like flashes, and bright lines of light are obtained.

The Kaleidotrope is a somewhat similar effect, and serves to illustrate in a very pleasing manner, what is called the persistence of vision. It consists of an opaque disc, perforated with holes of different sizes and connected to one end of a spiral spring, the other end of which is fixed to a holder or frame, any movement given to the disc will produce circles and interlacing rings of light on the screen. By varying the movement of the disc you can get some very pretty figures. For the production of the effects which I am now about to describe, we shall require two (and in some cases three) lanterns.

The Smoke Effect is easily shown, and is remarkably effective. It consists of two slides, one an ordinary photographic transparency or painted picture of a volcano, Fig. 63, or steamer, or gipsy encampment, or other subject in which smoke will come in conspicuously. The other slide is a rackwork one, the fixed glass in which is stopped out except a funnel-shaped space where the smoke is to appear. The smoke is painted in wavy patches along a space, say an inch wide near the centre of the moveable glass, as shown in Fig. 64. The first picture, Fig. 63, is dissolved on ; then the smoke slide is put (upside down of course) into the second lantern, and the dissolver pushed back at the same time as the handle, A, is slowly turned. The smoke will then appear to issue in the most natural manner from the crater. The only difficulty in showing this effect and others of the same class, is in getting the smoke slide in exactly the right position with respect to the other one. It is very evident that if it be pushed in too far or not far enough, the smoke instead of appearing to come out of the crater, will appear to come out of the sky. It could, of course, be easily altered so as to get it into the right position ; but effects lose half their charm if they are not shown right in the first instance. The best way is to try the effects beforehand, and when you get them exactly right to gum a little wedge on to the top of each frame to serve as a stop. If one of the slides should appear too low in the slide-stage, a thin piece of wood gummed on to the top of the frame, will raise it to the required height. I said " on to the top of the frame," because the picture being always turned upside down, the top, practically speaking, becomes the bottom. It should be observed that the crater is not in the centre of the picture, but a little to the left. The blank space on the fixed glass of the smoke slide must correspond in size with the mouth of the crater, and in exhibiting the smoke slide, care must be taken to turn the handle the right way, otherwise, the smoke will appear to descend. A moment's trial will determine which is the right way. Other subjects can with a little ingenuity be adapted to the smoke slide, and the effect may thus be exhibited again and again.

The Four Seasons Effect is well worth the trouble of arranging. You must have four slides of the same subject which should be some country scene, a landscape with fields and meadows, an old mill, etc. The first is coloured to represent spring, the second summer, the third autumn, and the fourth winter, with snow and ice. The four slides must be made to register exactly, so that you can dissolve one into another imperceptibly. If the slides are nicely coloured, and figures are introduced engaged in operations appropriate to the different seasons, the effect of the gradual change from spring to summer, from summer to autumn, and from autumn to winter, will be very pleasing. When the last picture of the series is shown,

The Snow Effect can be introduced. This is probably the most realistic of all the effects, and is at the same time one of the easiest to produce. Two little rollers are mounted one on either side of a wooden frame or holder of the usual size. Both these rollers can be turned by means of the handles A and B, Fig. 65 ; a long strip of black silk, linen, paper, or other opaque material is fastened to them in such a way that it can be wound off one roller and on to the other by turning the handle of the roller on which it is to be wound. A number of pinholes are made in the strip, which holes, when the strip is unwound *upwards*, will look exactly like *falling* snowflakes. A portion of the strip sufficient to cover the opening in the frame should be left at both ends without any pinholes, then a few pinholes should be made and then more and more as the middle of the strip is approached. The snowstorm will then appear to increase gradually until it attains its full severity, then it will gradually get less and less until it stops. The whole strip should be wound on to the roller, B, before the frame is put into the lantern, then if we turn the handle, A, which is uppermost in the lantern, we shall be

certain that the snow-flakes will fall. Of course, if we were to unwind the strip downwards, the snow would appear to rise. It is on paying attention to trifles of this sort that much of the success of an entertainment, as a rule, depends. If the snow-flakes are not clearly seen, it is owing to the strip being out of focus. The strip should be some eighteen inches long.

Moonlight Effect.—The best way of showing this effect is to have two slides of the same view—one coloured to represent daylight, and the other coloured an intense greenish blue in imitation of a moonlight view. The two slides being made to register exactly in the lanterns, the daylight scene appears slowly to give place to moonlight by dissolving one into the other. An old ivy-covered castle or abbey is a very favourite subject for this effect, and the ghost previously described can be shown with it. The double lever slide on which the ghost is painted is put into the first lantern in place of the daylight scene, a book is then held in front of the objective, and the dissolver turned aside. The ghost can be flashed on at any moment by quickly removing the book, the levers worked as often as required, and then, at the proper moment, the ghost made to "vanish into thin air" by holding up the book again. If a transparent screen is used so that the spectators cannot see how the effects are produced, they will appear much more startling. There is another way of showing the ghost, which is sometimes very effective. It is the old-fashioned phantasmagoria arrangement in which the ghost, when first shown, is quite small, but rapidly increases in size until it becomes colossal in its proportions, filling the whole screen; then it begins to decrease in size until it vanishes. The effect is produced by putting the lantern with the ghost slide close to the screen, and then gradually moving it away from it, altering the focus as you move it until the ghost fills the screen. You then push the lantern back again reversing the focus until the ghost is flashed off.

If the moonlight scene has an expanse of water, such as a lake or river in the foreground, it might effectively be arranged as a slipping slide. There should be dark clouds in the sky, and a ripple on the water; then by pulling out the slipping glass the moon could be made to appear from behind the clouds, and the beautiful effect of the silvery light dancing on the rippling water could also be shown. In these moonlight views wherever the moon's rays are supposed to fall the glass is left plain, or the lines and patches of light are scratched out on the slide after it is coloured. Another effect that can be produced is that of making a boat or swan glide by on the water. The swan could be mounted as a single lever slide, and then as it floated across the scene, it could be made to bend its head in a very natural manner. In showing it, you must be very careful not to make it float too far, and also be sure that it floats only on the water, and does not leave its native element and glide over dry land.

All these effects may, with the exercise of a little ingenuity be varied and extended in dozens of ways. I have not space to do more than explain how the principal effects are produced, and must leave the reader to adapt them to his slides.

The Storm Effect comes in very well after a moonlight scene, or the two effects may be combined. Let us suppose that we wish to exhibit in the most effective way one of our fine old castles—if it is a haunted castle so much the better. We first show it as an ordinary coloured photograph (daylight view); then by moonlight with some of the effects described above; then the windows can be made to appear as if lighted up and figures shown passing before them; then the sky gets overcast, dark clouds roll up, and lightning flashes in the most natural and vivid manner; then, when the storm is at its height, and the castle itself is nearly obscured, we dissolve it into a room in the castle with one of the inmates starting up at sight of some ghostly figure which passes before the window.

The storm effect is produced by mounting the moonlight view in a frame similar to that used with the panoramic slide described in the last paper. The clouds are painted on a glass 10 or 12 inches long, which slides in the grooves in front of the view. A space of about 3 inches is left plain at the inner end of this glass, so that the view may first be shown without the clouds. If you wish to light up the windows of the castle, you must have a slipping glass arrangement behind the slide. The windows to be lighted up are coloured a reddish yellow on the slide itself, and a space just sufficient to cover them is stopped out on that part of the slipping glass which would be opposite to them when the glass is pushed in. Close beside these stopped out places, and so arranged as to pass before the windows when the glass is pulled out, you paint the upper half of the figure you intend to show. They must be painted black, and should not be too large or too numerous. When you have made them pass two or three times before the windows, push in the glass which will put out the lights, and proceed with the storm effect. This is shown by pushing the long glass through the frame. The clouds are so arranged as to appear more and more stormy as the outer end of the glass is reached. A greyish tint should be painted over the whole of the latter half of the glass so as to partly obscure the view. This tint should at first be faint, and then gradually get deeper; because, of course, as the sky gets dark, the whole scene must get dark too. To heighten the effect the light in the lantern may

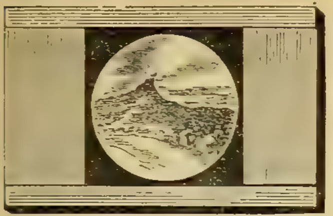


FIG. 63.—SMOKE EFFECT—VOLCANO.

be slightly turned down. The lightning slide, Fig. 66, is put into the other lantern, and flashed on and off as quickly as possible and as often as required.

The slide is very easily made. It is merely a stopped out glass, on which a zig-zag line has been scratched out and coloured a brilliant yellow. This line, when flashed on to the dark clouds, has exactly the appearance of lightning, and can be shown on different parts of the sky by moving the slide in the lantern or the lantern itself. If you move the lantern you must remember that a very slight movement will produce a considerable alteration in the position of an object on the screen.

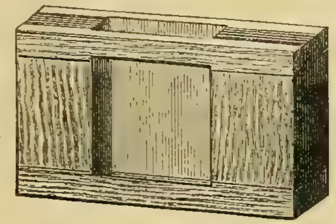


FIG. 68.—GLASS CELL FOR CHEMICAL EXPERIMENTS.

The effect of the apparition at the window is produced by means of two slides: one is an ordinary coloured slide representing one of the rooms in the castle, with a large window near the middle. This is shown first, and the second one is put into the other lantern and brought on when required. It is a slipping slide, the fixed glass of which, with the exception of a space exactly equal to the size of the window, is stopped out. The window frame is marked out in black lines, also the curtains and hangings, if there are any. The apparition is painted on the slipping glass, and the glass all round it is stopped out. When the slipping glass is pushed in the apparition will, of course, be hidden behind the opaque part of the fixed glass, but on drawing it out the form will appear to pass before the window outside the building. The effect may be shown in another way. The apparition is painted in the space left for the window (the framework being clearly marked out over it),

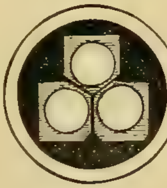


FIG. 62.—SLIDE SHOWING CHROMATIC EFFECT.

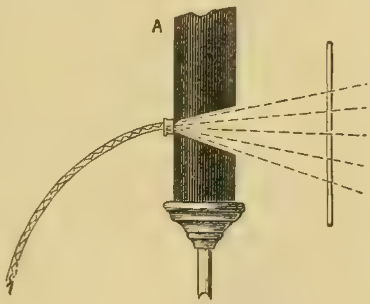


FIG. 67.—CASCADE EFFECT.

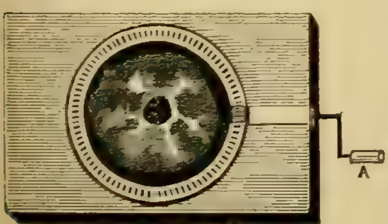


FIG. 64.—SMOKE EFFECT.

the light in the lantern is then turned down, the slide put in, and the light gradually turned up; the ghostly form will then appear to grow out of the darkness. Then the light is gradually turned down, and the apparition fades away again into the darkness. The slipping slide is not in this case required.

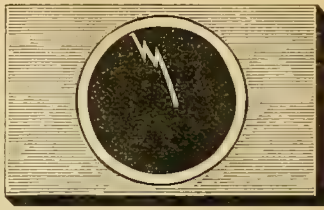


FIG. 66.—LIGHTNING EFFECT.

The Rainbow Effect can be produced in two ways, either by painting a rainbow as an ordinary slide and projecting it on to the sky of a suitable view, or by means of a prism. The former is the simpler method but the latter is the more natural and surprising. In either case, two lanterns are required. When the rainbow slide is used all the glass round the coloured band must of course be stopped out, and the light in the lantern should be lowered so that only a faint image of the rainbow may be seen. When the effect is produced by means of a prism, a black card with a bow-shaped slit, is put into the carrier of the second lantern; this, of course, would show as a white band on the screen; but on holding an ordinary prism in front of the objective, the white band vanishes, and in quite a different part of the screen, or it may be on the floor or on the ceiling, a rainbow-tinted band will be seen. By tilting the lantern this coloured band, which is really a very good imitation of a rainbow, can be brought into the proper position on the screen, and shown in connection with a waterfall or some other appropriate subject.

The Fountain Effect.—Two slides and the slide tinter (or a set of gelatine films) are required for this very pretty effect. One slide represents a fountain with the usual mer-

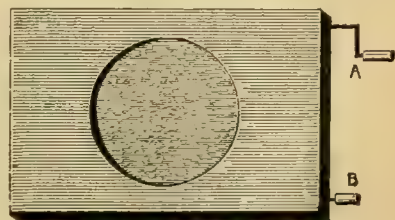


FIG. 65.—SNOW EFFECT.

maids, dolphins, and other figures, from which jets of water are thrown up, and the basins, etc., into which the water falls. The other slide is a rack-work arrangement of three glasses, on two of which wavy lines are painted of a very delicate grey or blue grey tint in resemblance of water. These glasses being rotated in opposite directions, a very good representation of falling water will be the result. The third glass which is placed before the others is stopped out, clear spaces, however, being left in it wherever the jets of water are to appear. The slide-tinter greatly enhances the effect by colouring the water. Three lanterns should be used when this effect is shown, so that you can bring on the next picture without having to stop the fountain, which should be kept working all the time it is being exhibited.

The Cascade Effect is a beautiful experiment with real water. Only one lantern is required, and the objective is removed. In its place is stood the upright glass vessel, A, Fig. 67. The vessel has a small hole bored at one side, from which when filled with water a fine unbroken stream will flow, as shown in the figure. The whole surface of the vessel is stopped out with the exception of a circular space opposite the hole, just large enough to allow the rays of light proceeding from the condenser to pass through the vessel, which is so placed that the point of the focus may be exactly at the orifice.

If the light is now turned on in the lantern, the stream of water will be most brilliantly illuminated. Gelatine films, placed between the condenser and the vessel, will tinge the water. If the light is momentarily interrupted by waving a stick in front of the condenser, the water will resemble golden balls. Three things must be noted to insure success : first, that the vessel is the right distance from the condenser ; second, that the hole is smooth and perfectly round so that the water issues from it in a regular flow (a glass tube is sometimes fitted into the hole, as shown in the figure to form a spout) ; and, thirdly, that there is no draught to disturb the stream.

Chemical Experiments.—These are so numerous that even to name them would require pages. I will, therefore, confine myself to describing two or three as examples of the many uses to which the lantern can be put.

For chemical experiments, a glass cell, Fig. 68, is indispensable, two or three glass rods or pipettes, which are glass rods with an india-rubber ball at one end and drawn to a point at the other end, will also be required. The cell can easily be made out of two pieces of white glass fitted with marine glue, into a varnished wood-frame, or clumped together with a piece of india-rubber about half an inch thick between them. This cell is placed in the slide-stage in place of the carrier. If you intend to show a number of experiments, you ought to provide yourself with at least half-a-dozen of these cells, to save time in washing them out.

Put a weak solution of nitrate of silver into the cell and suspend a copper wire in the solution. The wire will very soon become encrusted with silver, the actual deposition being clearly shown on the screen.

Put some alcohol into the cell, and carefully let a single drop of one of Judson's dyes fall into it. A very pretty tree-like figure will be formed. A drop of another colour may be put into a different part of the cell, so as to produce a second tree, the branches of which will interlace beautifully with those of the first one.

The well-known experiments of changing the colour of certain fluids, by dropping acids or alkalies into them, are very easily shown.

The development of a photograph can be shown on the screen—in fact, the whole process of photography from the coating of the glass, in the first instance, to the final production of a finished positive can be demonstrated to a numerous assembly in the most striking manner by means of the lantern ; of course, the room must be dark while the plate is being coated, and the development must be carried on in a cell having, on the side nearest the condenser, a ruby coloured glass. The light from the lantern will be sufficient to print the picture or to take a negative ; if one of the rapid emulsions is used, the exposure being determined by previous trial. These photographic experiments are amongst the most effective that can be shown on the screen. There is, for most persons, a fascination in watching the lines of the image gradually appearing on the screen as if they were being traced by an invisible hand.

Galvanic Experiments.—Probably the most interesting of this class of experiments is that for showing the action of the electric current, in depositing one metal upon another. You will require a small battery (one or two cells, pint size, of a bichromate battery will do), a piece—say half an inch square—of thin sheet gold, a piece of copper gauze of the same size, a couple of pieces of copper wire, two binding screws, and a short stick of cyanide of potassium (this being a most deadly poison, will be rather difficult to obtain). You begin by fastening the binding screws, one to each end of your cell, then fix the wires to them, and connect the gold sheet to one wire and the copper to the other, and let them hang opposite to each other in the cell, close together but not touching. Put the cyanide into the bottom of the cell and fill it up with water, then connect the two poles of the battery with the binding screws by means of two insulated wires, and immediately bubbles will be seen passing off from

the gold plate, and very soon the plate itself will show signs of wearing away, while particles of metal will be carried across to the copper gauze, the meshes of which will presently be filled up. The bubbles are, of course, globules of hydrogen, obtained by the decomposition of the water. In connecting up the battery the negative pole (zinc end) must always be connected with the copper gauze (called the cathode), and the positive pole with the gold or anode.

The decomposition of water, the deflection of the magnetic needle, under the influence of the galvanic current, and many other similar experiments can be performed. The amateur electrician will easily be able to arrange the requisite apparatus for exhibiting them in the lantern.

Electro-Magnetic Experiments.—A small electro-magnet, the poles of which are bent towards each other, should be fitted into an ordinary slide-frame. Its outline can then be projected on to the screen. What are called the magnetic lines can be shown by letting some fine iron filings fall between the poles. The first filings will cluster round the poles, and if more are sprinkled over them, they will bridge over the space in the form of a series of semicircles or arches. The single cell bichromatic battery may be used with this electro-magnet, or any other battery that the Amateur may have by him. With these experiments I conclude the present series of papers on "The Magic Lantern."

(*Concluded.*)

BEE-HIVES AND BEE-FURNITURE.

By WALTER J. STANFORD.

IV.—Bee-Keeper's Plant—The Smoker—Bellows—Spring—Barrel—Funnel—Feeders—Hole's Improved Dummy Feeder—Wax Melter—Honey Extractors—Abbott's Little Wonder—Cylinder Extractor.

We next come to work requiring combined knowledge of tinsmith's, blacksmith's, carpenter's, and handyman's trades; but I am sure there are plenty of amateurs who possess sufficient knowledge to execute all the work described in this paper. I hope, however, to give a full explanation of the mechanism of each article, and any part beyond the operator's skill can easily be supplied by a professional. I will begin with one of the most useful and necessary pieces of a bee-keeper's plant, namely, "the Smoker." Having read what Cowan says about this appliance, start and make one. Fig. 40 shows a view of the Smoker completely finished. Fig. 41, the Bottom Board of the Bellows with spring and valve in position, and the leather attached. Fig. 42, Top Board of Bellows. Fig. 43, the Barrel with the arrangement for fastening it to the Bellows. Fig. 45, the Handguard.

First make the bellows. Procure two pieces of English walnut $6\frac{1}{2}$ inches by $4\frac{1}{2}$ inches by $\frac{7}{16}$ inches when cleaned up, and cut off the two top corners of each, as Fig. 42, about $\frac{3}{4}$ inch on each side. Plane up another piece of walnut, $4\frac{1}{2}$ inches by $\frac{3}{4}$ inches by $\frac{11}{16}$ inch, and screw it exactly in the middle of the outside of the top board, with its $\frac{3}{4}$ edge uppermost, and one end level with the end of the top board. With a $\frac{5}{16}$ inch centre-bit, and centre $1\frac{1}{8}$ inch from the end, bore a hole right through both pieces. Plane up two pieces of deal or pine $3\frac{3}{4}$ inches by $\frac{1}{2}$ inch by $\frac{1}{4}$ inch. Nail one of these on the inside of the top board, almost level with the end which has not been deprived of its corners. Having cut the bottom board exactly like the top board, with a $\frac{3}{4}$ inch centre-bit and centre $1\frac{5}{8}$ inch away from the end, bore for the valve. To construct the valve itself, cut out a little piece of soft wood $1\frac{1}{4}$ inch by 1 inch by $\frac{3}{8}$ inch. Draw a line across the top of it, and with a chisel take off a couple of shavings on either side of the line towards the ends, so as to leave the line as a ridge. Get a piece of thin leather $1\frac{1}{2}$ inch by $1\frac{1}{4}$ inch, and fasten it with one tack in the centre, to the underside of this piece, flush with three edges and projecting $\frac{1}{2}$ inch on the other. Lay this over the centre of the hole in the bottom board, and fasten the projecting piece of leather, with a couple of tacks to the bottom board. Another strip of leather $2\frac{1}{2}$ inches by $\frac{3}{8}$ inch tacked across the ridge, so as just to allow the valve a little play, completes that part of the bellows.

The spring is a very simple one, and is the same as was described in the last paper for tightening up the sections in a section rack, and can be obtained from any dealer in bee appliances for a penny. Get a piece of thick leather about 3 inches by 2, and fold it twice, pass this through the loop of the spring and screw it to the centre of the bottom board 1 inch away from the end. The loop of the spring will have to be sunk about $\frac{1}{8}$ inch into the wood. Nail the second of the two $3\frac{3}{4}$ inches by $\frac{1}{2}$ inch by $\frac{1}{4}$ inch pieces to the inside at the near end to match the corresponding piece on the top board. Procure a piece of good Persian leather and cut it to the size and shape, Fig. 46. Beginning in the middle of the near end of the bottom board, with glue, and a tack here and there, fasten the leather all round the bottom board, lapping over and gluing the joint. A better joint would be made if the two ends were first prepared by being slightly pared down. Let the glue set. Next bend

two pieces of galvanised wire to this shape, ⊓, with an internal length of $3\frac{1}{4}$ inches to form clamps to keep the top and bottom boards in their places while fixing the leather to the upper board. The bellows can now be put together and a $\frac{3}{8}$ inch strip of red leather fastened round the edges of both boards with brass-headed nails to give finish to the whole.

FIG. 53.—FRONT OF HOLE'S SYRUP FEEDER.

The barrel, Fig. 43, is 6 inches long and 2 inches in diameter. In making the tinwork of this no solder must be used, as the heat would melt it at once and make the whole thing useless. This difficulty is surmounted in the usual way as shown in magnified section, Fig. 48. Using this joint all through, make a plain cylinder 6 inches long and 2 inches in diameter, outside measurement, with a bottom.

Cut a piece of tin $3\frac{1}{2}$ inches by $1\frac{1}{4}$ inches, and turn about $\frac{1}{4}$ inch at each end at right angles; with the shears cut a slight curve in each of the turned up ends to correspond with the curve of the barrel. Cut a second piece of tin 7 inches by 3 inches, as shown in plan, Fig. 47; fold its two long edges back $\frac{1}{8}$ inch, and hammer them down. Along the dotted line A B, Fig. 47, turn the two edges up at right angles, and along E F turn the end in the same direction at right angles. Cut a third piece of tin $2\frac{3}{4}$ inches long, and sufficiently wide to allow its edges to be turned back and hammered down, and then turned up at right angles, trough-shaped, to fit over the wooden support on the back board of the bellows. Take these three pieces just cut and shaped, and rivet them together with two rivets, keeping the two short pieces directly over each other (the long piece in the middle), about $1\frac{3}{8}$ inches away from the angle end of the long piece. Lay these three on the barrel with the turned up, or angle end of the long piece under the bottom of the barrel. Bend down the top of the long piece to touch the barrel, and fix the three in place by two rivets at the top and two through the bottom. Before the rivets are finally fixed a $\frac{1}{2}$ inch hole must be cut through the support into the barrel to correspond with the hole into the bellows. Open out this hole in the tin part, slightly, to receive a piece of cone-shaped tin tubing, which has its largest end fixed into the wood of the bellows, and its narrow end projecting $\frac{1}{4}$ inch inside the barrel. A better job would be made of this if the broad end of the tin tubing was passed right through into the bellows, and its ends turned over the wood and hammered down. The barrel can now be attached by four screws to the support on the bellows. A hand-guard, $5\frac{1}{2}$ inches long, Fig. 45, is screwed on over, and not touching the barrel. The top and bottom edges of this are bound with iron wire.

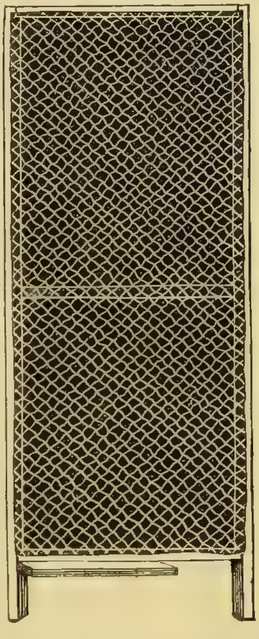


FIG. 57.—CAGE FOR "LITTLE WONDER" HONEY EXTRACTOR.

The funnel is made in two parts. Make first a plain cylinder 1 inch deep, with inside diameter just large enough to fit on to the outside of the barrel. To this is jointed the funnel, $5\frac{3}{4}$ inches long, narrowing down to $\frac{7}{16}$ inch in diameter at the nozzle. Fig. 49 is a grate fitting into the barrel, standing about $1\frac{1}{2}$ inches high to protect the tin tubing from the burning fuel. To complete the whole cut a circular piece of sheet iron, Fig. 44, large enough to be able to jam it firmly into the funnel about $1\frac{1}{2}$ inches from the wide end. Punch a series of $\frac{1}{8}$ inch holes in it before fixing it in place; this is to prevent ashes, etc., falling into the hive. The best fuel for using in it is well-dried cotton rope, such as is used in factories for driving light

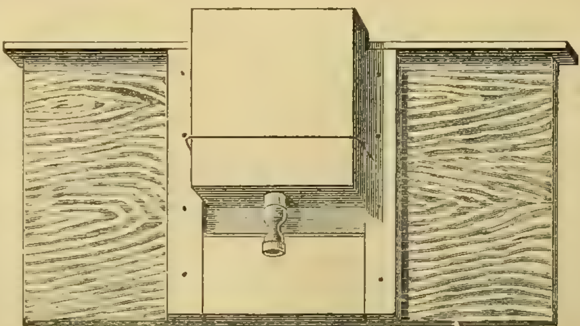


FIG. 52.—BACK OF HOLE'S SYRUP FEEDER.

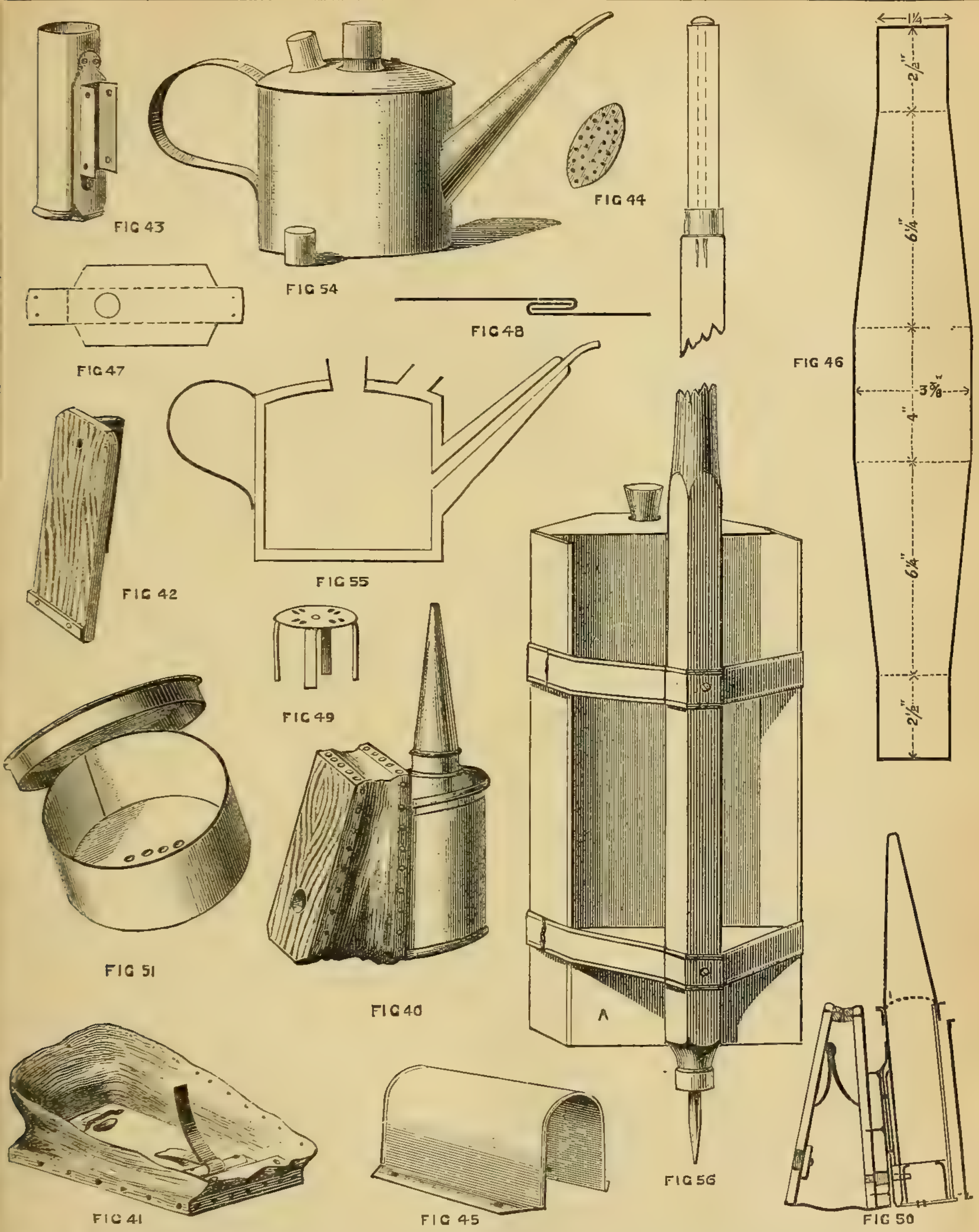


FIG. 40.—SMOKER, COMPLETE. FIG. 41.—BOTTOM BOARD OF BELLOWS, WITH SPRING AND LEATHER VALVE. FIG. 42.—TOP BOARD OF BELLOWS. FIG. 43.—BARREL OF SMOKER. FIG. 44.—GRATING FOR INSIDE OF FUNNEL. FIG. 45.—HAND GUARD. FIG. 46.—PLAN OF LEATHER FOR BELLOWS. FIG. 47.—PLAN OF PART OF TIN SUPPORT FOR BARREL. FIG. 48.—SECTION OF JOINT IN TIN ENLARGED WITHOUT SOLDER. FIG. 49.—GRATE FOR INSIDE OF BARREL. FIG. 50.—SECTION OF SMOKER THROUGH CENTRE. FIG. 51.—CHEAP TIN SYRUP FEEDER. FIG. 54.—WAX SMELTER. FIG. 55.—SECTION THROUGH CENTRE OF WAX SMELTER. FIG. 56.—"LITTLE WONDER" HONEY EXTRACTOR. NOTE THAT THE DIAGRAMS ARE NOT TO SCALE.

machinery; but if this is not obtainable hemp carpet, rolled to fit the diameter and length of the barrel, is the next best material; but fustian, corduroy, and brown paper, rolled in the above manner, will do. Light one end after rolling, and put it down into the barrel; puff it gently at first, till you get it burning well. When not in use it should stand upright to keep it alight. Fig. 50 gives a section of the whole complete through the centre, and if you study the diagrams you will have no difficulty in turning out a good smoker.

We next come to Feeders. In the ordinary course of affairs bees require feeding in the autumn and spring, and there are two great methods of supplying them with food—viz. (1) Dry sugar feeding; (2) Syrup feeding. Both have their advantages and disadvantages. I always feed by the second method, and as I can speak with certainty of it as generally successful, and at present have not tried the other, I advise beginners, at any rate, to feed with syrup.

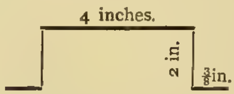
Every bee-keeper almost has his own special devices for syrup feeding (which are of course *the best*), and I am no exception to that rule. Till lately, I have used nothing but the feeder shown, Fig. 51. This is simply a common tin box, 4½ inches in diameter and 3 inches deep, with a lid. Four holes are punched in the centre of the bottom with a square punch, and a *little* slit cut from each hole into the tin. These holes are then plugged with rolls of worn out calico. The syrup oozes down through the slits, and the bees, hanging on the ends of the plugs, take it as they want it. These are very cheap and simple. I buy the tins for 4d. each, the above size. Last year, however, at the Bee Show at the Indian and Colonial Exhibition, I picked up a feeder which took my fancy very much. I tried it in the autumn with a very late driven stock of condemned bees, which I put on eight empty combs at the end of September. This stock absolutely refused to feed from my usual overhead feeder, but took greedily to the same food supplied in this feeder, down outside the brood nest, as a dummy. Fig. 52 shows the back of it, and Fig. 53 the other side, where the bees get the food. They only cost 1s. each from J. R. W. Hole, *Tarrington, Ledbury*, the inventor, and if you get one as a sample, it will be very easy to make more if you are successful with it.

To construct it, however, make a tin box 5 by 4 by 2 inches, air-tight all round. In the centre of one of the short sides solder a small tin tube 1 in. long and ¾ in. diameter, and along one of the edges between this side and one of the flat sides punch four or five pin holes.

To make an air-tight cap for this tin tube, get a piece of indiarubber tubing about 2 inches long, and slightly smaller than the outside diameter of the tube. A cork can be pushed into one end of this, and sealed over to secure absolute exclusion of air. If air can get in anywhere, the feeder will leak when turned upsidedown. The pressure of the air left inside the box when full, is equalised by the pressure at the holes, and the bees can suck down the syrup as they want it.

To make the wood part of the feeder, cut and plane up a piece of white deal 14½ inches by 8½ inches by ¼ inch. Out of this, in the middle of one of the long sides, cut a piece 3⅜ inches by 3¼ inches. Nail an ordinary top bar 17 inches by ⅞ inch by ⅜ inch along the other long edge.

Now call one of the flat sides "front" and the other "back." Across the grain on the back nail two pieces 8½ inches by 1 inch by ½ inch, so as to leave a space between them in the centre of 4 inches, just big enough for the tin to fit between, and at the bottom, across the square hole just cut, nail a piece 4 inches by 3 3/16 inches, so as to leave a slit 1/16 inch wide above it. Bend a piece of light iron wire to this shape. Bore two small holes in the centre of the sides of the two cross bars, 2 inches above the slit, and put the two projecting ⅜ inch ends of the wire into these holes.



Directions for using Hole's Improved Dummy Feeder.—This dummy, or division board, should be placed in the hive in such a position that the bees can only get at the perforated edge of the syrup tin, through the slit in the face of the dummy. When it is necessary to remove the tin raise the wire and lift it without jarring. Fill the tin with syrup, cork it securely, and invert it for a moment over the syrup jug to catch the few drops that will drip. When this stops, replace the tin in its position in the dummy, and see that the perforated edge comes against the slit, and rests on the ledge provided for it. To reduce the feed, stop some of the perforations with wax. The great advantage of this feeder over almost all others is, that it does away with the necessity of cutting holes in the quilts, and is thereby a heat economiser.

Fig. 54 shows a wax smelter, which is often useful for melting and keeping wax hot, for fixing foundation, filling cracks, and other similar jobs. It consists of two parts, and its construction is clearly shown in section in Fig. 55. The inside vessel is made first, and is oval in shape, about 3 inches long, 2 inches wide, and 2¼ inches high. Solder (soft) joints can be used for this, as it is to contain liquid; but it is safer to use the joint described before as well. Fix a piece of tin tubing 1½ inches long, and about ½ inch in diameter, in the middle of the top. A spout about 4 inches long, bent similar to the section, Fig. 55, is soldered on near the bottom. An outer tin case is made to fit this, so as to leave about ¼ inch all round inside between the two, and an oval shaped hole cut in

front for a spout; the inner case is then put into the outer case, with the long spout through this hole. Cut a top for the outer case, with a hole in the centre to let the tube of the inner case pass out. Solder another piece of tubing to the lid opening only into the outer case, and add a smaller piece as a steam escape, as shown in Fig. 54. Two tin caps are made to fit over the two central tubes. A spout attached to the outer case, wrapped round the inner spout, about 1 inch from its end, and a handle soldered on behind, complete the smelter. To use it, melt scraps of wax in a jam pot or other vessel, by standing it over the fire in boiling water; then fill the inner case with this wax, and the outer with water; put on the caps, heat over a stove, and pour from the spout as required.

Honey extractors come next. If an apiary is being worked for profit, an extractor is indispensable. Cowan describes their uses fully, so I will deal with construction. There are two sorts commonly in use (1) Abbott's Little Wonder, Fig. 56, which only extracts from one comb at a time; and the Cylinder Extractor, Fig. 58, which can be constructed to take two or four combs at a time. The Little Wonder is a capital machine if only a few combs are to be extracted, and is still largely used in small apiaries, as they can be bought very cheap, but if you intend to keep many hives, go in at once for the cylinder pattern, as they save enormously in time and labour.

I will, however, describe both, and take, first, the simple Little Wonder. To make its handle, procure a piece of ash, if possible, 3 ft. 8 in. by $1\frac{3}{4}$ in. by $1\frac{1}{2}$ in. when cleaned up. Also two brass rings, $1\frac{3}{16}$ inch diameter. Measure 1 ft. 10 in. from one end of the handle, leave that square and round off the other half. Bevel off the bottom of the square half to take one of the brass rings, and sink the second on to the other end flush with the wood. Cut a piece of $\frac{1}{4}$ inch round iron, 6 inches long; round one end, and drive the other into the bottom of the square end of the wood, leaving about 2 inches projecting. Get another piece of $\frac{1}{4}$ inch round iron 10 in. long, and a couple of $\frac{7}{8}$ inch washers, also a piece of wood, equal in outside diameter to the top of the round part of the handle. Bore a $\frac{3}{8}$ inch hole right through this. Hammer down one end of the 10 inch piece of iron, rivet shaped, and spike the other end; put on the two washers up against the rivet head, then the round piece of wood, and drive the rest of the spike into the top of the handle, boring for it first. The top short piece should turn freely on the iron pivot.

To make the tin part, cut two strips of tin $18\frac{1}{2}$ inches by 3 inches, and bind one edge and one end of each with iron wire. Cut another piece $18\frac{1}{4}$ inches by $11\frac{1}{4}$ inches, and bend it in the arc of a circle, so as to have the two long edges $9\frac{3}{4}$ in. apart. Turn up these two edges about $\frac{1}{4}$ in. at right angles, and solder the plain edges of the two strips first cut, inside.

Cut another piece of tin $10\frac{1}{4}$ inches by $9\frac{1}{2}$ inches. This is to form the bottom of the can and the back piece, A, Fig. 56. Turn up therefore 4 inches of it at right angles, and round off the other edge to correspond with the arc of the front of the case; bind with iron wire the top end of the 4 inch piece, turn up $\frac{1}{8}$ inch at right angles with the other edges, and solder it to the outside to form the bottom and back of the case.

To make the top which carries a spout in front, cut a piece of tin, 10 inches by 4 inches, bind one long edge with iron wire, and round off the other; turn up the two short edges $\frac{1}{8}$ inch at right angles, add a $1\frac{1}{4}$ inch circular spout, as near the rounded edge as safe, and solder the whole in place. Next cut two strips of tin $13\frac{1}{2}$ inches by $1\frac{1}{2}$ inches and solder them as bands across the round front to the two sides, each with their centre line about 4 inches away from the top and bottom. Cut two more strips $18\frac{1}{2}$ inches long and 2 inches broad, bind both their long edges with iron wire, and bend them to form the attachment to the handle shown, Fig. 56. Punch two screw holes in the back of these pieces, and with two screws fasten the whole to the handle about 7 inches from the ground. The back of the case should stand about 5 inches away from the handle.

To make the cage, Fig. 57, construct a frame of outside dimensions, $16\frac{1}{2}$ inches by $9\frac{3}{8}$ inches, with two feet, each 2 inches long, of red deal, 1 inch by $\frac{5}{8}$ inch. Nail a bar across in the centre for strength, and a 6 inch by $1\frac{3}{8}$ by $\frac{1}{2}$ inch, ledge at the bottom projecting $\frac{3}{4}$ inch to support the frames of comb, while extracting; complete it by fastening a piece of wire netting across the frame.

A wooden back is necessary for the whole, made by squaring up a piece of $\frac{1}{4}$ inch deal, $16\frac{1}{2}$ inches by $9\frac{3}{4}$ inches. Across the grain, $2\frac{3}{4}$ inches from each end, nail two bars, one $9\frac{1}{2}$ inches by $\frac{1}{2}$ inch by $\frac{1}{2}$ inch, and the other $10\frac{1}{2}$ inches by $\frac{1}{2}$ inch by $\frac{1}{2}$ inch, the longer one projects $\frac{1}{2}$ inch on each side, prevents the back slipping right through, by catching on the top tin attachment.

To use it, put the cage inside, with the feet standing on the bottom, uncap both sides of a frame of comb, and rest it on the supporting ledge against the wire netting. Sink a small brass cup into a board on the ground, stand on the board, and revolve the extractor in the cup, which should contain a little oil, the honey on the *inner* side of the comb will be ejected by centrifugal force, and will collect at the bottom; when one side is done turn the frame and extract the other.

(*To be continued.*)

MODEL ENGINE-MAKING.

By JOHN POCOCK.

IX.—CRANK FORGING — CONNECTING-ROD — FITTING PARTS OF ENGINE TOGETHER.

REFERRING for a moment to my last paper, I find that the price asked in some of the London shops for crank forgings is excessive, as much as 4s. being asked for this simple article which any country blacksmith will make "while you wait," for 6d. All that is necessary is to get him to weld a piece of $\frac{3}{8}$ inch iron $1\frac{1}{4}$ inches square on to a piece of $\frac{3}{8}$ inch bar, and from this you can then turn up first the shaft, and afterwards file out the crank. Fig. 74 shows the forging in question.

As already mentioned, the connecting-rod from bearing to bearing should be just twice the length of the stroke of piston, which in this instance will give us a length of four inches.

The rod may in the first place be forged out of a round bar of iron, the ends being forged out flat, or a flat piece of iron half-an-inch wide and a quarter thick may be taken, the middle part filed roughly to shape, and then turned down as shown in Fig. 75. Drill the top end of connecting-rod for crank bearing, and also drill two screw holes in top, now saw across as shown by the dotted line in Fig. 75, and enlarge the screw holes in the top piece and tap those in the rod itself, for the screws which are to fasten the two parts of the bearing together. Another way of making the bearing in the connecting-rod is shown in Fig. 76, the top piece, A, may be filed up from a piece of steel, and then fitted on the connecting-rod, and a $\frac{3}{32}$ inch hole drilled through as shown by the dotted lines in B. A pin is to be filed to size and run through the hole, and the two parts being thus firmly held together, the hole seen in B is to be drilled to fit the crank.

We will now commence to fit the different parts of our engine together, finishing and adjusting each piece as required. If the bed-plate has been bought with the castings, the positions of the various parts will be found marked upon it, but if the bed-plate is a home-made one, it will be necessary to set out the positions of the cylinder, guide-bars, etc., from the drawing already made, as shown in Fig. 77.

The lugs in the cylinder must be bored, and two pieces of $\frac{1}{8}$ inch steel about $\frac{5}{8}$ inch long must be screwed into them. The position of these bolts relatively to the top and bottom of the cylinder, must be taken with the compasses and marked on the bed-plate, and a couple of holes must be drilled through the latter to allow the bolts to pass through. A couple of nuts screwed to the bolts will now hold the cylinder firmly down in its place. Should the cylinder prove to be not perfectly level on the bed-plate, it must be removed and the lug at the high end filed away until it is found that the piston-rod is perfectly level with the bed-plate, when drawn out to its full extent.

The pillars to go between the guide-bars should now be turned up. These are turned up all in one piece and afterwards sawn apart, when they will present the appearance shown in Fig. 78; their height should be just a shade over the thickness of the guide blocks, which are in this case $\frac{1}{4}$ inch thick, before being sawn apart. The whole piece may be bored with an $\frac{1}{8}$ inch hole, or this may be done to each pillar separately.

The top guide-bars are now to be centre-punched at each end, and drilled with an $\frac{1}{8}$ inch hole. These top bars are then to be placed upon the lower bars, and the position of the holes in the top bars marked, centre-punched and drilled in the lower bars. These latter must now be placed in position upon the bed-plate, and the position of the holes again marked and drilled in this latter. Both bed-plate and bars should be marked so that they may always be put together in the way in which they were marked for drilling. Before putting the guide-bars together, the lower ones may be roughly filed down to near the correct height; and as the distance between the guide-bars will be $\frac{1}{4}$ in. and the piston-rod will work in the centre of them, it is obvious that the top surface of the lower guide-bars must be $\frac{1}{8}$ inch nearer the bed-plate than the centre of the piston-rod. Four bolts about $1\frac{3}{4}$ inch long, with small steel nuts, will be required to bolt the guide-bars to the bed-plate. These bolts are passed through the guide-bars with the pillars between them, and the whole thus secured in position.

The crank-shaft standards may next be finished off. A $\frac{1}{4}$ or $\frac{5}{16}$ inch hole is to be bored in each standard, and two screw-holes drilled in the top of each to the depth of half-an-inch. Then the tops are to be sawn off at the lines marked on the castings, and the screw-holes tapped for $\frac{1}{8}$ inch screws. The feet of the standards must also be drilled to take $\frac{1}{8}$ inch bolts or screws, the former being preferable. The crank-shaft may now again be put in the lathe, and the parts which are to rest in the standards turned down to fit the holes in the latter. The bearing at the fly-wheel end will only be turned down the width of the thickness of the standard; at the other end, however, it will be a good plan to turn the shaft down to the same diameter to within half-an-inch of the crank, as the hole in the eccentric will not then need to be larger than those in the standards, and the small eccentric supplied with model castings scarcely admits of a larger one.

The eccentric should be bored out to be a good t in its place on the shaft, and a small hole is to be

bored through the boss upon it sloping inwards into the larger one. This is for the set-screw and should be tapped for $\frac{1}{8}$ inch screw. The set-screw itself is to be made from a piece of steel wire $\frac{3}{8}$ inch long, and screwed and finished with a nick in the top for screw-driver, no head being necessary.

The crank-shaft is now to be placed in its bearings in the standards, and the whole placed upon the bed-plate. Now see that the shaft is directly at right angles with the piston-rod, and then mark the positions of the holes in the feet of the standards upon the bed-plate. Drill the latter, and bolt the standards down.

plate, and pass the steel cross-head through the piston-rod head and connecting-rod, and screw the guide-blocks on each end. The height of the guide-bars with respect to the piston-rod, of the pillars between the upper and lower bars, and also the thickness and distance apart of the guide-blocks must now be all carefully adjusted, so that the blocks will run smoothly and easily and without any shake between the guide-bars.

The slide-valve rod may be made of steel wire, say $\frac{3}{32}$ inch thick, rather under than over. The eccentric band must of course be drilled and screwed to receive

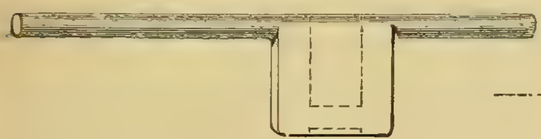


FIG. 74.—FORGING FOR CRANK.

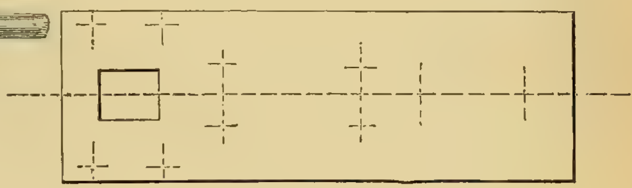


FIG. 77.—BED-PLATE MARKED OUT.

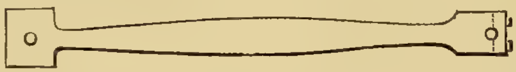


FIG. 75.—CONNECTING ROD.

FIG. 78.—PILLAR FOR QUICK BARS.

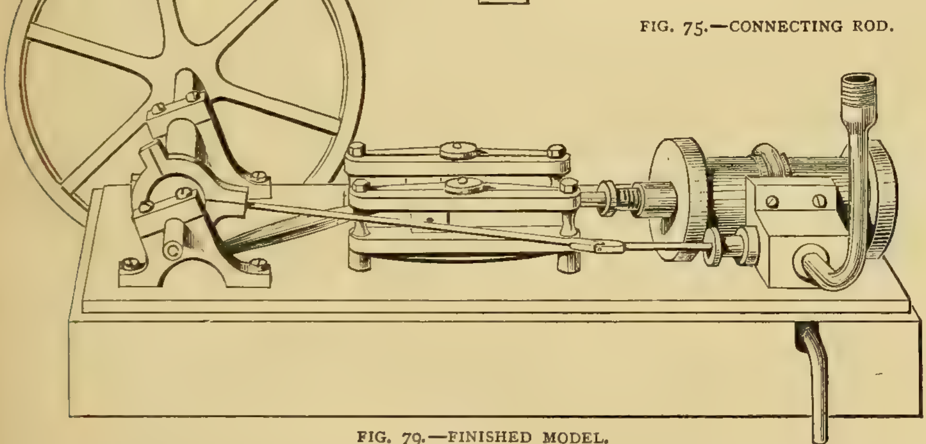


FIG. 79.—FINISHED MODEL.

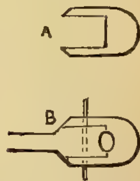


FIG. 76. — ALTERNATIVE FORMS OF HEAD FOR CONNECTING-ROD.

The head of the piston-rod may now be bored and tapped, and drilled with a $\frac{3}{16}$ inch hole for cross-head, and the rod may then be cut off to the length shown in the working drawing and screwed. The piston being in place screw on the head, now attach the connecting-rod to the crank, and with the piston about $\frac{3}{8}$ of an inch from the bottom of the cylinder, mark the position of the holes in the piston-rod head upon the connecting-rod. Take off this latter and drill as marked.

Take a piece of $\frac{3}{16}$ inch steel $1\frac{3}{4}$ inches long and screw both ends, leaving $\frac{5}{8}$ inch in the middle not screwed. Drill the guide-blocks and tap with the same thread. Now take the guide-bars off the bed-

one end of the rod, and a joint must be made in the rod about two inches from the steam-chest stuffing-box. The short piece is to be filed flat on two sides $\frac{1}{16}$ of an inch from its end, for a distance corresponding with the length of the valve, so that it will drop into the slit in the latter, and will move it on over the ports without allowing any end play. The joint in the valve-rod may be made from two pieces in brass wire $\frac{3}{16}$ inch thick; these are each drilled and screwed at one end, to receive the ends of the two parts of the rod; in the other end of one piece a saw-cut is made, and a flat filed on the other piece to fit the saw-cut: these two pieces are now to be put together, the flat of one into the saw-cut of the other, a small hole drilled through

the joint, and a piece of wire put through as a pivot, and riveted with one or two light taps with the hammer.

The eccentric must now be put in place on the shaft, and the length of the rod so adjusted that when the strap is at its farthest from the steam-chest, the lower port shall be just as much open as the upper port is when the strap is at its nearest to the steam-chest; of course, for this purpose the steam-chest must be taken off and the engine turned on its side with the cylinder face uppermost, so that the valve may lie upon this latter.

The fly-wheel may be turned and bored upon the face-plate of the lathe, or it may be keyed on to the crank-shaft and turned up in position. The shaft must be filed away a little on one side and a corresponding flat filed in the fly-wheel; a small key very slightly wedge-shaped is then to be driven into the space thus made between the wheel and shaft.

An exhaust-pipe may be screwed into the exhaust-port of the cylinder, brought through a hole in the bed-plate and bent outwards, and a steam-pipe should be screwed into the steam-chest.

If it has not already been done, the burrs left at the edges of the screw-holes in the cylinder-covers, steam-chest, etc., must be rubbed off and a little white and red lead put between such parts as are required to be steam-tight before they are finally screwed together. Before the steam-chest is screwed on, however, the eccentric must be fixed by means of its set screw in such a position upon the shaft, that the valve will open the lower port just as the piston is at the bottom of the cylinder, and the upper port just as the piston is at the top of the cylinder.

Oil-holes may be drilled in the centre of the top guide-bars, the plummer blocks, and anywhere else that may be thought necessary.

The engine may now be mounted upon a solid block of wood, the size of the bed-plate and 2½ inches thick, a hole being made in the top of the block to make room for the various nuts under the bed-plate, and a slot cut for the exhaust-pipe; and the bed-plate being screwed down to this block we may consider our model finished.

Fig. 79 shows the engine in its complete state, and from this diagram the relative disposition of the different parts of which it is composed will be easily recognised. The making of this engine, or of an engine of any other kind, as I have already remarked in previous papers, will be found excellent practice. Indeed, the amateur who can command skill and perseverance enough to construct and complete a model of this kind need not despair of being able to accomplish engineer's work of far more ambitious character.

(*To be continued.*)

DRY-PLATE PHOTOGRAPHY.

By C. C. VEVERS.

XI.—PRINTING (*continued*)—PREPARING NEGATIVE—MATERIALS REQUIRED—CUTTING PAPER—PLAIN PRINTING—MASK PRINTING—VIGNETTE PRINTING—CAMEO VIGNETTES.

PHOTOGRAPHIC PRINTING may be roughly divided into three styles or classes: Plain, Mask, and Vignette. The former style is employed for views, buildings, groups, and full-length portraits; masks should be used for portraits exclusively; while both views and portraits may be vignetted. I will describe the three styles in succession, but, first, the negative must be "got ready" for printing. The varnished negative is laid face down on a clean felt pad or other soft and level surface, the back, or glass side, is now cleaned with a damp cloth and afterwards polished to remove any emulsion that may have run over the back at the time of coating. Any surplus varnish, which the amateur may have spilt over the back of the plate, instead of returning to the bottle, must be scratched off with a knife, very little pressure being used or the negative may break. When the back is quite free from film, dirt, or varnish, the negative is examined by transmitted light, and any pin-holes or other transparent flaws in the film carefully filled in with Prussian blue water colour. To do this, it will be necessary to rest the negative against something; the window may be used, but a retouching desk is far the best and safest method of supporting the negative.

Although not to be recommended, the high lights may be strengthened and shadows reduced by the application of Prussian blue to the back of the plate; while, if the subject be a portrait, it is almost certain to require more or less retouching. An exhaustive article on this subject, including directions for making a desk, appeared in Vol. V., page 182.

The materials required for actual printing are few, viz., a few printing frames for each size of negative—say half-a-dozen each quarter and half-plate size, of the ordinary form (Fig. 46), and made of teak or mahogany, the latter are a little stronger and of better finish than the teak frames, the price of which is about quarter size, 6s., and half size, 10s. per dozen, while the cost of mahogany ones is considerably more; sensitized paper, the production of which was described in the last paper, or it may be bought ready sensitized at about 13s. per quire, or 9d. or 10d. a sheet; some makers also supply the paper ready cut to size, measuring about 3⅝ by 2¼ for carte-de-visite and 5⅝ by 4 for cabinets, it saves some trouble in cutting and trimming, and packs into very little room, but is soon

spoilt if the edges become torn or frayed in washing, and it must also be placed exactly in the required position on the negative, as, of course, the print cannot be trimmed afterwards as may a piece the full size of the plate. The price of ready cut sensitized paper is about 4s. per quarter quire of 258 carte-de-visite or 90 cabinet pieces, or 1s. per sheet cut to 43 carte-de-visite or 15 cabinets. A light-tight box should also be provided for holding the sensitized paper; this box should be divided into two compartments, one for printed and the other for unprinted paper.

Now as to cutting the paper. Out of one sheet 32 quarter pieces may be cut thus: the thick lines in Fig. 47 divide the whole sheet into quarter sheets, while if each quarter sheet is cut along the thinner lines, it will give 4 double quarter pieces, which if folded along the dotted lines, back to back, may be placed in the frame double, and when one side is printed the paper is reversed and the other side laid on the negative. Twelve half-plate pieces may also be obtained from one sheet, thus: A quarter sheet is doubled, not in half as for quarter-plates, but within about 2 inches of the opposite edge, this will give two half-plates (or one whole-plate) longitudinally, and a strip about 4½ inches wide, which, if cut carefully, will give one half and one carte-de-visite piece. As many as 42 carte-de-visite and 15 cabinet pieces may be obtained from a whole sheet by cutting according to Figs. 49 and 50, but to do this it is necessary to have the sheet complete (*i.e.*, not in quarters), and the pieces thus cut being very small, allow of very little trimming; therefore, the beginner will find it the easiest, and perhaps the most economic in the end, to cut the large pieces which are almost full-size of the plate.

The printing frames are now examined to see if the ledge on which the negative is to rest is perfectly level, as the slightest inequality is almost sure to cause the negative to crack when pressure is applied; the back is next examined and the hinges made to work freely; in a new frame they often work rather stiff, and may require oiling. The negative is now laid face up in the frame, and the sensitized paper placed upon it in the required position; of course, the albumenized or glossy side being against the negative, a felt pad or several pieces of blotting or soft paper, cut rather smaller than the negative, are laid behind the paper, which is held in its place by the left hand at one end of the frame, while the paper is laid over it from the other end. The back is laid on in the same manner so as to prevent the paper from slipping; it is held with the left hand while the springs are secured with the right hand. Should the back be not perfectly firm when the springs are fixed under the staples, it will be necessary to add more padding of felt or paper. Printed paper should not be used for pads, as the ink is liable to be transferred to the sensitized paper. The frame and its contents are now placed facing the source of light, either indoors or outside, according to the state of the weather; of course, the light is much stronger outside than when it has to pass through a window. If the negative be a dense one, with plenty of light and shade, the frame may be placed in the sun where it will print very rapidly, but if it be at all thin from over-exposure [or under-development, it should be printed in a weak light away from the sun. In the sun an average negative will take from 10 to 25 minutes to print, while in the shade the same negative will need from 20 to 60 or more minutes; very dense negatives require an hour or two to print, and in some cases even *days*, while thin negatives will print in a few minutes. Unlike dry-plates, however, the image is visible during printing, and can be examined from time to time to see what progress has been made. To do this, the frame should be taken in to a very feeble or yellow light, and holding it with the left hand one of the springs is steadily loosed, half the hinged back and the pad are then separately raised; next the sensitized paper is lifted back, examined, and if not dark enough allowed to fall back into its original position, which it will do if the other half of the back has not been moved during the examination; the back is replaced and the spring again fixed under the staples.

The paper must be printed a shade *darker* than it is desired to have the picture when finished, as it becomes lighter in the fixing bath. When sufficiently printed, the paper is removed and replaced by a fresh piece (if duplicate copies are required); or if the piece be a double one, it is turned round, and the same operation again gone through. It is hardly necessary to say that unless the negative becomes damaged in some way any number of prints may be made from it Publishers of photographs of celebrities, and the like, possess negatives from which many thousands of prints have been made; unusual care is, however, taken of these valuable pieces of glass, and very few would pass through the amateur's hands so successfully; moreover, photographic publishers usually have duplicate negatives, and when one is injured another is ready for use. Should the negative be spotted with red stains caused by silver from damp paper, it may be cleaned by rubbing over the spots a piece of soft cotton dipped in a solution of potassium cyanide (poison), the exact strength of which is immaterial. It may be necessary to remove the varnish; this may be done by immersing in methylated spirits, as previously described, the negative afterwards being washed, dried, and revarnished. A cracked negative may be printed from if the film is not broken, by placing the frame so that the crack runs

in the direction of the light; by this means little or no shadow is thrown on the paper beneath. If the varnish becomes "tacky" in printing, it is a sign that it is either too soft, or has not been sufficiently heated after flowing on the negative; it should be removed with spirit and the negative revarnished.

Now for "Mask" printing. All my readers will have observed that in a photographer's show-case the majority of the portraits are surrounded by a white margin of shapes varying according to the style of portrait enclosed. This margin is obtained simply by placing between the negative and sensitive paper a piece of opaque paper, the centre of which has been stamped or cut out, leaving an opening shaped as required. These masks, as they are called, are sold in packets containing a variety of styles and sizes of openings. The shapes most generally used are oval (of which a number of different sized openings are supplied), dome, cushion, and square. Ovals are used for head and bust portraits, and the other shapes for half and full-length figures, and sometimes for groups. Having selected a mask of suitable shape and size, it is placed on the *varnished* side of the negative, and secured in position by a small strip of gum paper; the sensitized paper is laid over this and printed in the usual manner, the result being that where the opaque paper has protected the sensitive paper from the light the latter is perfectly white. I have seen these masks used by amateurs for views, and even buildings, with, I consider, very inartistic results.

FIG. 55.—VIGNETTE FOR HEAD AND BUST PORTRAIT.

We next come to "Vignettes," a style of printing which, if more difficult and requiring greater attention than plain and mask printing, will amply repay the amateur with the beautiful results produced. A vignette is a photograph with a white margin (as in the former case), but without any hard abrupt lines; the picture is gradually gradationed into the white margin, producing a most soft and charming effect for both portraits and landscapes alike. A piece of millboard is required, large enough to cover the front of the printing frame, that is, for quarter-plates about 6 in. by 5 in., for half-plates about $8\frac{1}{2}$ in. by $6\frac{1}{2}$ in. In the centre of this cardboard roughly draw in outline the

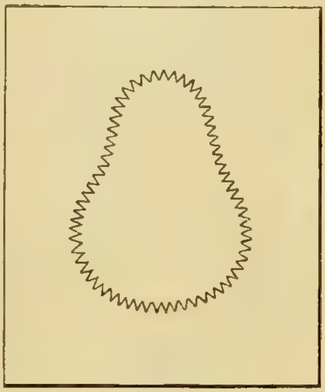


FIG. 57.—VIGNETTING CARD.

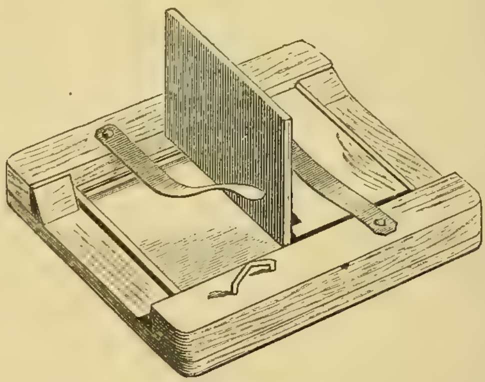


FIG. 46.—PRINTING FRAME.

FIG. 56.—SHAPE OF VIGNETTE FOR VIEW.

shape of the picture desired to be vignetted, but rather smaller in size. For head and bust portraits the opening to be cut should be pear-shaped, as shown in Fig. 55; while for views oval is generally the most suitable shape (Fig. 56). Next cut out the portion thus marked, and with a pair of scissors serrate or "gimp" the edge as in Fig. 57, about $\frac{1}{8}$ inch or $\frac{3}{16}$ inch deep. The negative is now placed in the frame and the vignetting card laid on the

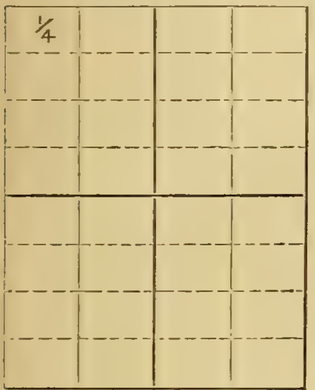


FIG. 47.

FIG. 51.

FIG. 52.

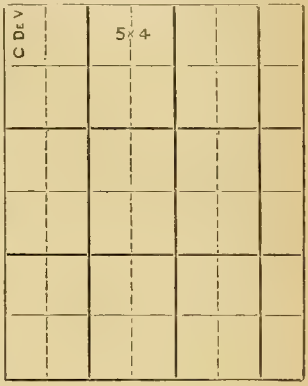


FIG. 49.

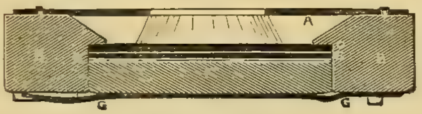


FIG. 58.

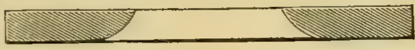


FIG. 59.

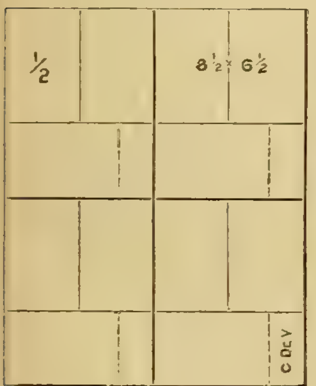


FIG. 48.

FIG. 53.

FIG. 54.

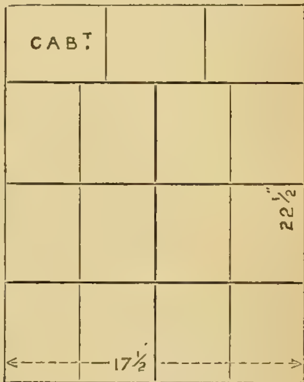


FIG. 50.

FIG. 47.—DIAGRAM SHOWING HOW TO CUT 32 QUARTER PIECES FROM ONE SHEET. FIG. 48.—DITTO, 12 HALF-PLATES AND 4 CARTES DE VISITE. FIG. 49.—DITTO, 42 CARTES DE VISITE. FIG. 50.—DITTO, 15 CABINET PIECES. FIG. 51.—OVAL MASK. FIG. 52.—CUSHION MASK. FIG. 53.—DOME MASK. FIG. 54.—SQUARE MASK. FIG. 58.—SECTIONAL VIEW OF PRINTING FRAME, SHOWING VIGNETTING CARD IN POSITION.—A, Vignette Card; B, Printing Frame; C, Negative; D, Sensitive Paper; E, Padding; F, Back; G, Spring. FIG. 59.—SECTION OF VIGNETTING BOARD WITH BEVELLED OPENING.

outside, and the whole held up to the light so that it may be seen if the card is in its proper position on the frame; if this is so, it is secured to the frame by a couple of drawing-pins, small tacks, or elastic bands; the former being, however, the best. The paper is now inserted, the back fixed in its place, when the whole should be as shown in section, Fig. 58. The frame can now be taken outside to print. The light where the frame is placed should be as even as possible, and for this reason the frame should not be placed near a wall, and on no account must it be placed in the sun, or the serrated edges of the vignetting card will be included in the picture. The vignetting card being raised about half an inch above the negative, the light at the edges is diffused; and, with the aid of the serrated edges of the vignetting card, gradually softens away until it is unable to reach those portions of the paper which are to remain white.

If it is desirable to print or vignette in the sun, a piece of tracing or tissue paper, free from holes, must be gummed over the opening in the vignetting card. Some printers prefer to use in place of the serrated card, a piece of thick board, with the opening cut out and bevelled at one side $\frac{1}{2}$ inch or more (Fig. 59). These boards are laid on the negative; but this method necessitates a large number of boards with different shaped openings to suit the variety of negatives, so that this style of vignette printing is hardly practicable for the amateur, but is only suitable for the professional, who does, of course, a large quantity of vignette work. The same may be

said of vignette glasses (pieces of glass stained at the edges with a non-actinic colour, and gradationing off to transparency in the centre) and waxed vignetting papers, which are printed papers made semi-transparent with paraffin wax. I may say, however, I have tried almost every description and method of vignetting, but never succeeded so well as with the simple piece of cardboard, which has the additional advantage of being alterable in shape, if required, at any time during printing. If the light comes principally in one direction, it is advisable to partially turn the frame round several times, so as to equalize, to some extent, the uneven light. It must be remembered that a vignetting frame must not be left to "look after itself;" vignette printing is a part of photography in which a great amount of care must be expended in order to become at all proficient. A *perfect* vignette printer is very scarce, and, in the profession, such a person is equal to the retoucher, and can demand a salary sometimes even higher than either operator or retoucher.

A few years ago a very popular style of portraiture was what was then known as "Cameo-vignettes," a combination of mask and vignette printing, which sometimes improved a head-and-bust portrait. With each set of masks a similar set of "discs" are usually supplied; these are merely the central portion of the mask, which being stamped out from the same piece of opaque paper, should fit exactly to the mask. After printing a vignette head in the usual manner, an oval disc somewhat larger than the extreme visible edge of the vignette is laid over the print and covered with a piece of glass to keep it flat, or, if preferred, it may be returned to the printing frame, a sheet of clear glass taking the place of the negative. That portion of the paper unprotected by the disc will be quickly darkened by the action of light, and when the desired shade has been reached, the print is ready for toning; the picture thus obtained being a vignette, surrounded by an oval dark margin. This form of print after toning, should be enamelled, and after mounting embossed in the cameo press, when the photograph will present a rich and well-finished appearance. Enamelling and embossing will be described in their turn.

An agreeable change from the dark margin is one of fancy pattern, which is obtained by making a reduced negative of a fancy printed paper, such as are sometimes found at the back of the books, or even a photograph of wall paper will do. This negative is used in place of the sheet of clear glass to support the disc and sensitized paper in the darkening process, and, of course, prints the design upon the margin. The pattern employed should be very subdued, and without violent contrasts.

The photograph of a view is often much spoilt by the mass of glaring white, supposed to represent the sky—such a sky as is rarely seen in this part of the world. It is usual to print in the sky from another negative, but one has only to look round any of our photographic exhibitions to see how the advantage of printing in skies is abused; the amateur seems to go to the other extreme, and it is remarkable to note how stormy the weather must have been when these photographs were taken, and how well (?) black and watery clouds suit a serene and smiling landscape, on which the sun is evidently shining brightly. This gay bit looks as though it knew not what a dark and lowering sky, such as hangs above it, is. Still more curious is it to observe how that same scrap of stormy sky with its clouds tearing along at racehorse speed, seems to have followed the photographer on all his tours—to the sea, on the mountains, in the dales, in bleak Norway and sunny Italy—everywhere, in fact, wherever the photographer has had his camera that same sky has happened to be; it matters not if the light on the view be from the east or from the west, that same sky does equally well for all, and a little "cross lighting," the photographer evidently thinks, improves the picture and adds a novelty to the scene, which must attract the attention of the critics. And it certainly does.

If a view will be improved by the addition of a sky, print a sky, but don't make the picture all sky and no view; don't have the light coming in two directions; and don't use one sky negative for twenty different views. Sky negatives are easily made, and the amateur should have a stock of at least half-a-dozen, so that he may select the one most suitable, without producing a pictorial libel.

A fleecy sky should be selected, such as are seen in the autumn or spring; the finest clouds are usually near the sun, towards evening, but do not include the sun in the picture or the negative will be worthless for printing from. The clouds are focussed, smallest stop and slow plates used, and a "cap off and on" exposure is all that is necessary. Perhaps a little intensification of the negative will be an improvement after development.

If the view to be "skied" is over-exposed and prints with a dark sky, the latter must be shielded during printing by a piece of cardboard, the edge along the horizon being slightly raised from the negative thus: , so as to, in a sense, vignette the sky, which would otherwise leave a dark line. After printing the view, the sky negative is placed in the frame, and a similar piece of card fastened this time over the printed view, the edge turned up as before to vignette the sky into the horizon line, so that it does not print in the view, nor end abruptly in the sky. If the horizon be uneven with buildings, trees, etc., the

card should be shaped accordingly, but unless the projections be of a light shade, the sky will not show if printed over trees, masts, and the like. For very rough horizons a writer in one of the photographic journals recommends using, in place of a card, a piece of cloth, such as a towel and shaping the edge of the material to the shape of the horizon. Take care not to turn your "Peaceful Sunset" into a "Just before the Storm" picture; don't overdo the sky printing: all that is necessary is that it is just distinguishable, rather have it too weak than too bold and heavy.

Combination printing—being a combination of two or more negatives, by very accurate vignette printing—is almost beyond the beginner and hardly comes within the scope of these papers. I may, however, treat upon the subject at some future time.

(*To be continued.*)

NOTES ON NOVELTIES.

By THE EDITOR.

48. Wood-working Machinery. 49. Skinner's Specimens of Woods. 50. The Wood Turner's Handy Book. 51. Screw Threads. 52. Lunt's New Catalogue. 53. Buck & Hickman's Catalogue. 54. "A Photograph, and How to Take It." 55. Electric Gas Lighting Apparatus. 56. "Loffel," or Ball-Spooning, a New Game.

48. WOOD-WORKING MACHINERY. — Messrs. George Richards & Co., Limited, send me the pocket edition of "Wood-working Machinery," under which name they issue a compendious, useful, and well-printed catalogue of the various pieces of machinery for effecting various operations in wood-working manufactured by them at their works, *Broadheath, near Manchester*. The London office and show rooms of the firm are at 23 and 24, *Whitecross Street, E.C.*, where a large number of their machines are always on view. The machines are many in number and diverse in operation, comprising, as they do, machines for pattern-making, termed dimension sawing machines, band-sawing, wood-planing, and turning, moulding, boring, mortising, tenoning, with a variety of saw benches, saws, and appliances for grinding, clamping, etc. As may be supposed, the greater part of the machines manufactured by Messrs. Richards & Co. are beyond the means and, indeed, the requirements of the great majority of amateurs. Attention, however, may be directed to Richards' Saw Setting Device for Circular Saws, a very handy appliance for the purpose for which it is intended, the face-plate lathe, and other wood-turning lathes made by the firm, which appear to be well constructed, and of the best possible workmanship.

49. *Skinner's Specimens of Woods.*—From Messrs. J. H. Skinner & Co., *East Dereham*, comes what I may call a handy little file of specimens of twenty different kinds of woods for cabinet-making, fret-cutting, turning, etc. They are strung on a piece of wire, numbered, and accompanied by a card with the names of the woods, preceded by numbers corresponding to those of the woods. Each specimen is just about $2\frac{5}{8}$ inches by $1\frac{5}{8}$ inches. I intend to mount my specimens in four rows, of five specimens in each row, glueing them on a background, and placing the panel thus formed in a gilt frame. Thus treated, it will be found very useful and convenient to hang up in the workshop for reference. Perhaps Mr. Skinner will prepare some of his specimens in this manner for those who do not care to do this for themselves.

50. *The Wood Turner's Handy Book.*—Very recently I called attention to the new edition of "The Metal Turner's Handy Book," by Mr. Paul N. Hasluck, A.I.M.E. Messrs. Crosby Lockwood & Co. now send me the companion volume, "The Wood Turner's Handy Book," also by Mr. Hasluck, which is every whit as desirable and useful a *vade mecum* for the wood turner as the former is for the metal turner. It is well and profusely illustrated, and after describing the construction of the lathe, the tools and appliances used in it and with it, the mode of filling it up, and the chucks necessary for different kinds of work, Mr. Hasluck calls attention to many articles which may be made by lathe-working and the *modus operandi* involved in the making of each. The price of the work, nicely and strongly bound in brown cloth, is 2s.

51. *Screw Threads.*—This is the title of a handy little book for the waistcoat-pocket, written by Mr. Hasluck and published by Messrs. Crosby Lockwood & Co. at 1s. It enters thoroughly and completely into the various methods of producing screw threads, with illustrations, and contains numerous tables appertaining to the subject, with full and complete directions for using screw-cutting lathes. Mr. Hasluck's book will be found to be extremely useful, if not a *sine qua non* by all amateurs who are able to manage screw-cutting in the lathe, or have any ambition to try their hand at this kind of work.

52. *Lunt's New Catalogue.*—Mr. A. S. Lunt, Saw, Plane, Tool, and Cutlery Manufacturer, 297, *Hackney Road, London, E.*, has just produced the sixth edition of his catalogue of the various tools and appliances made and sold by him. It contains eighty-two closely-printed pages, with numerous illustrations in every page, and forms a most valuable and useful price list and finger-post as to what to buy and where to buy it. It is a price list, I think, that will prove most desirable for the readers of AMATEUR WORK, whether professional or amateur, and as it is sent out gratis, it will cost the applicant nothing beyond the postage of his application, whether by letter or post-card. The prices have been revised throughout, and are in many cases considerably reduced from those quoted for similar articles in the preceding edition. It is evident that no pains have been spared to render the catalogue as complete as possible. There are many things in it to which I should like to call attention, but lack of space compels me to content myself with mentioning Mr. Lunt's Improved Malleable Iron Faces and Fronts for Wood Smoothing-planes, and the Patent Thumb-

screw Spoke Shaves, in which the blade is brought nearer to or farther from the wood by means of wing-nuts or thumb-screws working on a screw thread cut on each tang. I can recommend these specialities for adoption by amateurs.

53. *Buck and Hickman's Catalogue.*—Messrs. Buck and Hickman, manufacturers of Saws, Files, Planes, and Engineers' and Mechanics' Tools, 280 and 281, *Whitechapel Road, London, E.*, who are the general agents for "The Morse Twist Drill and Machine Company," send their "Illustrated and Priced Catalogue of Morse Twist Drill and Machine Company's Manufactures, American Chucks," etc., etc., bearing date, March, 1887. The catalogue itself, both as regards its contents and wrapper, in dead black and gold, is an excellent specimen of printing. The leading feature is, as a matter of course, the Morse Twist Drill in its different forms and sizes, with other drills, drill gauges, wire gauges, bits, stock drills, and countersinks, sockets, reamers, cutters, mills, dies, taps, wrenches, arbors, and drill-chucks, made by the same company, and in addition to these are the specialities in chucks of many American makers, such as the Cushman Company's Chucks, the Horton Chucks, the "Westcote" Patent Lathe Chuck, the Pratt and Whitney New Combination Chuck, Parker's and Stephens' Patent Vices, etc., etc. It will be useful to mention that Messrs. Buck and Hickman are the sole agents in London for the sale of the celebrated Naxos Union Patent Corundum Wheels, made in six different grades of fineness, from "extra fine" to "extremely rough," in sizes from 6 to 40 inches in diameter by $\frac{1}{4}$ to 6 inches in thickness; prices on application. The Naxos Union Emery Wheels, for gulleting circular saws, are made 12 inches in diameter, in sizes $\frac{1}{4}$ in., $\frac{5}{16}$ in., $\frac{3}{8}$ in., $\frac{1}{2}$ in., $\frac{5}{8}$ in., $\frac{3}{4}$ in., $\frac{7}{8}$ in., and 1 inch wide, supplied, respectively at 4s. 6d., 5s. 3d., 6s., 7s., 9s. 6d., 10s. 6d. 11s. 6d., and 14s. each.

54. "*A Photograph, and How to Take It.*"—Mr. E. G. Wood, Optician, 74, *Cheapside, London, E.C.*, and 416, *Strand, W.C.*, sends a copy of the new and enlarged edition of the pamphlet entitled, "A Photograph, and How to Take It," by "One who Knows." "It is issued," Mr. Wood writes, "*pro bono publico*," so anyone who desires to possess it may avail himself of Mr. Wood's liberality, at the cost of a post card, giving his name and address, and stating his wish to have it. The directions for beginners in the art of dry-plate photography are concise, but amply sufficient for all practical purposes. Every subject in connection with this branch of photography, of which it is necessary that the amateur should know something, being touched upon. The latter part of the pamphlet consists of a descriptive catalogue of Mr. Wood's photographic appliances and chemicals, including his "Trafalgar" dry plates, which are of excellent quality, and will develope with any standard developer. It may be useful for readers residing in the northern and midland counties to know that Mr. Wood has a branch establishment at 20, *Lord Street, Liverpool.*

55. *Electric Gas Lighting Apparatus.*—The Woodhouse and Rawson Electric Supply Company of Great Britain, Limited, whose head office and sample rooms are at 11, *Queen Victoria Street, London, E.C.*, have just brought out, under the title of Electric Gas Lighting Apparatus, a descriptive pamphlet of a novel and interesting system of gas lighting by electricity, by which all styles and kinds of gas burners can be ignited and extinguished by means of an electric current. The pamphlet gives a clear description, with prices, of the various kinds of apparatus used; sample sets, with instructions for fixing, being supplied at 21s. and 25s., which any fairly intelligent person may fix, if he follow the instructions given, in any place and to any burner where a means of automatically lighting the gas is of value. An engraving on the wrapper illustrates an entrance hall to a private dwelling, wherein an occupant, having occasion to go below during the night, steps from his room at the head of the stairs and touches a press button, when instantly his way is lighted ahead of him. To take advantage of this, however, it is necessary to leave the meter turned on all night, which is not the right thing to do. The only thing that would induce one to do this, would be the chance—a remote one, possibly—of astonishing any burglarious visitors in the small and early hours, by a sudden and instantaneous lighting-up of every burner in the house, when such an illumination was about the last thing to be expected.

56. "*Loffel*," *or Ball-Spooning—A New Game.*—Mr. James Gillingham, the well-known Surgical Mechanist, of *Prospect Place, Chard, Somerset*, moved by the perils with which our ordinary field games of cricket, football, etc., are beset, has formulated—I use his own expression—a new game, which he tells us is enjoyable and attractive, without being over-exciting, and with less danger. This new game he calls (at present) "Loffel," or Ball-Spooning, but I am afraid its name will give rise to much pleasantry on the part of those into whose hands the preliminary notice may fall, especially when it is noticed that by its adoption ladies may "do a little to Spooning without violence to body or risk to limb." Apart from this, however, Mr. Gillingham, has doubtless done good service in providing a game which can be played without risk of injury, and which demands a considerable amount of skill and attention to excel in it. It is played with a ball and an instrument very much like a large ladle with a straight handle, with which the ball may be either "spooned" or tossed, or struck, as there is a batting phase of the game. I am sorry that space prevents me from entering further into a consideration of the game itself, and from giving the rules; but I am sure that a letter to the inventor, whose name and address I have given above, will immediately obtain for the applicant a copy of the preliminary notice and the rules, with which I have been favoured. With regard to our field sports, I should be sorry to try to induce anyone to abstain from these simply because there is a certain amount of danger attendant on their practice, because I think myself that danger more or less dogs every step we take and every movement we make, and that if we were to be in constant fear of which might happen, we might as well come to a stand-still altogether. The danger chiefly arises from the violent, furious, and altogether irrational manner in which most games, especially cricket and football, are played, and from the intemperance displayed in their prosecution, in utter disregard of the apostolic—and therefore God's—command, to be temperate in all things, even in games.

AMATEURS IN COUNCIL.

For "Instructions to Contributors and Correspondents," see page 44 of this Volume, or Part 60, page 44.

Castings for Model Engines.

*** Readers of AMATEUR WORK requiring castings for model engines, are recommended to make application to such makers as Mr. R. A. Lee, 76, *High Holborn, W.C.*, or Messrs. Lucas and Davies, 21, *Charles St., Hatton Garden, E.C.*, as mentioned by Mr. Pocock, in his paper on Model Engine Making in page 326 of this Volume, otherwise Part 66.

E. S. (*Tonbridge*).—I am obliged to you for your communication on this subject. A letter from me to the person mentioned in your letter respecting the non-execution of an order has been returned, like yours, through the Dead Letter Office. I will give his present address when I am able to obtain it.

Copper Solution for Coating Iron.

GROOVED BARREL does not state whether his copper solution had been used before changing colour or not. It would also assist to know means used to effect the coating of the copper. He states: turns "blue" again and does not remain "clear." Does the word clear mean opaque and producing a slight precipitate, that further changes its colour? Taking it as "bluish" and slightly opaque, it possibly arises from the union of the cyanide with iron, or its salts producing "Prussian blue," which is soluble in ammonia. This would make no difference in the utility of the bath. But, more probably it arises from a decrease in the strength of the cyanide by its action on the copper anode (if one is used); or again by evaporation, leaving an unchanged "ammonia sulphate of copper" (blue) the same as produced in making the solution at first, prior to adding the cyanide. In this case add more cyanide, it will work then all right. Cyanide (fused) varies sadly in strength; if below forty per cent. throw it away, but mind where, for it is awfully poisonous. Sulphate of copper far too often contains iron, then powder it well, cover it with a piece of paper to keep dust away. After sufficient exposure to the air to turn all the iron into an oxide dissolve in distilled water; then the oxide of iron will deposit at the bottom. Decant clear solution, or filter solution, and so keep the iron salt clear from the cyanide.—R. B. [The query to which the above is a reply comes from India, but is without signature. The handwriting, however, and paper, which corresponds with communications received from GROOVED BARREL, leads me to attribute the inquiry to him, and I have therefore affixed his nom-de-plume to R. B.'s reply.—ED.]

A Few Words from a Professional.

JAMES JACKSON (150, *Lawrence Hill, Bristol*) :—"If ESOR will send particulars of his requirements to me, I will quote him a price for executing the same. I am open to do any kind of woodwork for amateurs, or to give lessons or advice on the use of tools, etc. The 'Amateur Mechanics' Association,' as suggested by A. F. C. (*Bombay*), in Part 64, ought to be a good thing, if they have classes taught by competent professionals. I find very many are anxious to supply amateurs with tools and materials, but very few or none to show them how to make the best use of them when purchased; and this is why many amateurs after spending money on tools and materials, throw them away in disgust after a short time, instead of persevering and becoming good workmen. I believe amateurs could and should be able to turn out the very best of work, for they are the only ones who work for the love of it, and this latter is what constitutes the true amateur. Those who learn to make or do some little thing merely to turn it into money when finished are no amateurs, and are not worthy to be classed as such. For my part, I have always my pet job at home after the regular day's work is over; and although in the same line of work, it goes very different when there is no thought of £ s. d. to harass one, and *I feel I can put my best thought and labour on it.*

Slide-Rest.

S. M. L. (*Goderich, Canada*).—You do not say which part gives way under the pressure of the cut. If it is the socket, then the set-screw is at fault, and the point should be hollowed or cupped and hardened, as in Fig. 1, which shows the proper form of set-screw point. If the

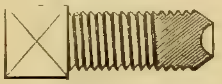


FIG. 1.—PROPER SET-SCREW POINT.

support fastened to the lathe-bed gives way by twisting on the bed, then it is due to the design, in that being open at the end the pressure from the holding-down bolt springs it, and causes an unfair bearing on the lathe-bed. If you had a good strong casting, with the end of the slot closed, it would undoubtedly be better. Fig. 2 shows

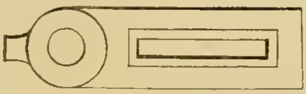


FIG. 2.—SUPPORT ON LATHE BED.

the proper form of support on lathe-bed. You could have a casting made with a tenon piece fitting between sides of lathe-bed, but that would hamper the scope of your slide-rest. If everything is properly tightened up your rest should not shift unless your tools are badly ground or very blunt.—OLLA PODRIDA.

"Every Man his Own Mechanic."

J. H. E. *Shepherd's Bush*).—The work named above may be described as a comprehensive synopsis of work done in the building trades, and especially such work as an amateur may carry out with satisfaction to himself. Subjects that are epitomised therein are treated more fully and in detail in AMATEUR WORK. Moreover, many, indeed the great majority of subjects handled in this Magazine, are not even mentioned in "Every Man his Own Mechanic."

Elementary Carpentry.

A COUNTRY PARSON.—If you purchase "Every Man His Own Mechanic," which was, so to speak, introductory to AMATEUR WORK, I think you will find very much, if not all, of the elementary instruction you require. To make a bead-joint such as you find in match-boarding, you must have a beading-plane wherewith to run the bead; and to make a V joint, connect your boards by grooving and tonguing, and chamfer the edges of the boards. For any particular operation you desire to carry out, write and say what the operation may be, and you shall have the fullest possible instructions, with diagrams, if required, in Amateurs in Council.

Cutting Letters in Stone.

J. H. E. (*Shepherd's Bush*) writes:—"I am very sorry to see by the April Part of AMATEUR WORK (page 284) that you have declined H. M.'s offer of papers on Stone Engraving, and do hope you will see your way clear to rescind that decision. For instance, take my own case of a few years back: When at a country town, I was following wood-carving and cabinet-making, when the proprietor of a marble yard wished me to do some lettering for him; but as I knew nothing whatever of the process, not even the kind of tools used; of course I was at a dead loss, trying my wood-cutting tools and a metal graver, and so on for want of better information. But he repeated his request, feeling confident I could do it, so I got him to take me up to the yard and show me the kind of tools used and how to go about it. He could not himself so much as cut the plainest stroke. However, it gave me an insight into the mode of procedure, and he let me take a block of marble and some tools back to try on. As a consequence, my name and address cut thereon was the forerunner of many a day's good earnings—the prices being far better than for woodwork. Of course, a few chapters in AMATEUR WORK on the matter would have been of invaluable assistance, having no one to give me any instructions that knew anything about it. So I do hope you will change your mind, for in these days one never knows what they may be called on to do to get a living, whether from amateur beginnings or otherwise; and I would like to learn about leaded letters." [You will note, on referring to the answer to H. M. in page 284, that I asked my correspondent to send his name and address, which he has not done, but which I hope he will do. I am always ready to meet the views of readers on any point, when the expression of a wish to have instruction on that particular point is general. If H. M., therefore, sends his address, and I find there are others besides yourself who wish for detailed instructions on Cutting Letters in Stone, I would afford every facility on my part for the satisfaction of their desires. It is not possible for me to say more than this: Knowledge of any art or subject, be it what it may, is useful; but some branches are more sought after than others, and while I endeavour as far as possible to provide for the wishes of minorities among the readers of this Magazine, it would be impossible on my part to disregard the views of majorities with regard to subjects to be treated.—ED.]

Organ Building.

H. W. (*Glasgow*).—There should be no leakage at the pallets. Your bellows is large enough, but the rise should not be less than 8 inches, and 10 inches would be better. There must be an escape of wind somewhere, possibly at the valves, if joints are sound, or the wind would not exhaust itself in ten seconds when no notes were played. It ought to take nearer ten minutes than ten seconds for a fully inflated bellows of that size to exhaust itself. I cannot recommend a thick coating of tallow over the brass plate in the windchest through which the pull downs pass, as it would be apt to clog the action, especially in cold weather. The fault here undoubtedly is that the holes are too large, they should only be just large enough for the pull downs to pass. A strip of leather over the brass plate would be best, pierced just sufficiently to admit the passage of the pull downs.—M. W.

SARRUSOPHONE.—Your letter refers to an answer given to a correspondent in Vol. II. At this distance of time I am unable to recall the specification referred to.—M. W.

Electro Gilding.

GROOVED BARREL.—Mr. Edwinson will supply some papers on this subject as soon as his engagements will permit.

Engraving.

W. H. (*South Hackney*).—There is no book that I can confidently recommend on engraving on wood, but I hope that instructions on this subject will appear eventually in AMATEUR WORK. Your question is somewhat vague, as you ask if I "know a cheap book on engraving, as far as regards writing, and if it is very difficult to do." Write again, and specify the kind of engraving you want to do, whether on wood or metal. If you wish to have your signature or any piece of writing, such as a circular, produced, from which to print as letterpress, it can be done by aid of photography and a chemical process, by which a block with writing in relief is obtained.

Typefounding.

W. H. (*South Hackney*).—Amateurs can manage typefounding, but the process is tedious, to say the least of it. Articles on the subject, entitled, "Typefounding at Home," will be found in Vol. IV., pp. 371, 414, otherwise Parts 43 and 44, which may be had for 6d. each. All parts of the Magazine are always kept in print and on sale.

Colouring Photographs for Magic Lantern.

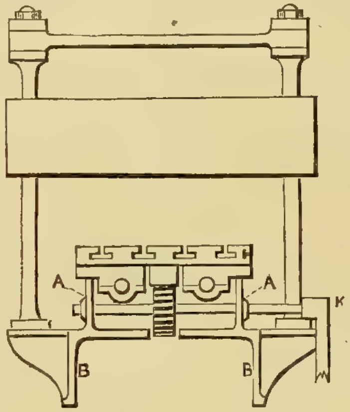
H. S.—The best way for you to colour your slides in oils will be to firstly varnish them with a clear white varnish, and then colour with transparent oil colours on the protected film.

The "Four Dollar" Chuck.

Messrs. CHARLES CHURCHILL & Co. write:—"We notice your correspondents have referred to the American 'Four Dollar' Drill Chuck, and you say you don't know why we don't keep it. We have sold this chuck for ten years under the name of the '1876 Drill Chuck.' It was brought out in 1876, and called the 'Centennial Drill Chuck,' in America. We called it the '1876 Drill Chuck.' It has been improved some in the time, but our 1876 Drill Chuck is the one your correspondents refer to." [Yes, but if the makers send out an article under two different names, and correspondents write about it under one name and you sell it under another, you cannot be surprised at my remark, seeing that the name "Four Dollar" does not appear in your catalogue.—ED.]

Another Hand Planer.

H. H. D. B. writes:—"I beg to call your attention to a mistake on page 190 in the present volume, in which the hand planer drawing, sent by me, is designated as a lathe planer, whereas it has nothing to do with a lathe, except as regards the slide-rest, and that is only used temporarily. The purpose for which I designed it for was to prevent the wear and tear of the lathe-bed, which most lathe planers occasion, and also to show how a planer might be cheaply made by anyone possessing a good



END VIEW OF PLANER.

lathe and slide-rest. I fail to agree with Mr. Balck's statement that it is costly; it is, in fact, quite the reverse. I also do not see that the round slide bars, if made stout enough, would spring much, and if they did, that could be remedied by placing two straight edged bars, A, A, as shown in accompanying sketch, parallel with the round bars, and fastened to the bed of the planer, the planer table resting on the top of these bars, as well as the round ones. These bars A, A, could be cast with the bed, if it (the bed) is made of cast iron. Their top edges would not be very hard to file true, as they would not be wider than ½ inch at the most. In the accompanying engraving the bars A, A, are shown cast with the bed B, B, which latter is on the horizontal engine bed pattern, as suggested by G.M.B., for whose comments I am much obliged. It will be seen that the bars A, A, have bosses cast on them, to serve as bearings for the traversing spindle, K."

STADT DRESDEN writes in comment on this to H. H. D. B.:—"Unless you have a large slide lathe, a commodity few amateurs possess, you will find the bars more troublesome to fit than a cast iron bed with *square edged* slides. V edged slides are unnecessary, and more difficult to make when everything has to be filed. Bars 3 feet long would have to be not less than 2 inches in diameter. Such a size would make an awkward clumsy machine. Nothing but the lightest cuts could be taken, and cast iron would require thorough annealing before it could be planed. Even then the bars would vibrate, and the action of the pinion on the rack would spring them upwards or (if the rack was below the pinion) downwards. The only way bars could be used with any satisfaction would be by giving them a support in the middle. But, after all, a planer is a troublesome and difficult thing to make, and if it is worth while undertaking at all, the little extra trouble required to fit the table on the slides is amply repaid by the superior work produced. It may be possible to make a wooden planer, but at the best it will only be a botch."

Photographic Enlarging Camera.

Mr. C. A. PARKER writes in reference to communication from A. K. (*Bournemouth*), page 239:—"I am very glad to hear of your success in making the enlarging apparatus described by me, but you must surely make a mistake in the cost of the condenser, Messrs. Lancaster or Marion's list prices both being 40s. for this size. Your first results being very good is fully explained when it is stated that Eastman's Permanent Bromide Paper has been employed for enlarging upon. The camera made by Messrs. Reoken, Son, and Rayment, bearing the trade mark of 'Optimus,' is a patent of Mr. Rayment, therefore I cannot describe how to make it; but if you are in want of an extension camera, I will, if desired by the Editor, furnish papers on the construction of a half-plate one, with a reversing frame, and all other necessary improvements. If an elastic mould is immersed in a depositing solution without being properly protected, it will naturally absorb the water and swell considerably; this may be prevented by immersing it *in the dark* in a weak solution of bichromate of potash, and afterwards drying it in the sun, thus providing it with an insoluble coating; or another plan may be adopted, thoroughly incorporate with the hot mixture 2 parts of tannic acid to each 100 of glue, which will render it insoluble."

Garden Frame.

TOLLY-OLLY.—You will find a paper on the construction of "Portable Garden Frames," by the Rev. A. Thorold, in Vol. V., page 255, of this Magazine, otherwise Part 53, which will, I think, give you all the information you require. If, however, the style of frame described does not meet your views, write again and state the kind of frame you wish to make.

Reflecting Telescope.

H. C. (*Manchester*).—You are to be congratulated on the possession of a 13 inch "With" speculum. To obtain steadiness is the grand aim in constructing the stand, and I should therefore advise you to make the plates D, D, in Fig. 106 (Part 63, Supplement), fully 12 inches across. The polar axis would also require to be lengthened about 6 inches. You will find considerable difficulty in following a star or planet comfortably with so large an instrument however, unless you attach an

apparatus to the stand for the application of the slower drawing power, which appears both in Fig. 108 and 109. The accompanying drawings show the method of attaching it. In Fig. 1, A is C, Fig. 106. B is D, Fig. 106, in different section. C is a piece of steel, about 1¼ inches wide, through which passes the centre pivot, and E, a clamping screw. D, a carefully turned gunmetal (or brass) ring, having cut around its outer edge an endless screw (female); this ring is entirely separate from B and C, but B is recessed, as shown, to receive it. E, the clamping screw. F, projection cast on to G. G, a worm wheel driving the ring D.

The manner of using the stand is as follows:—The casting, B, which supports

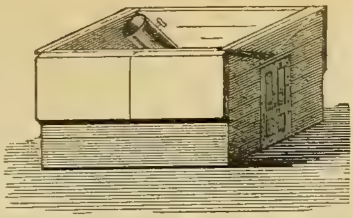


FIG. 10.—SHED FOR TELESCOPE—OPEN.

Hook's joint to a long handle. This is illustrated in Fig. 5. By means of this joint the handle can be used at any angle convenient. The following will explain the parts shown in Fig. 5, while Fig. 7 is also attached to Fig. 6 by the rivet C. Fig. 7 is bored square at B to fit on the squared end of the worm screw in Fig. 4. Fig. 9 shows completed joint.

I am sorry that I cannot recommend any special tradesman. Nor do I quite understand whether H. C. intends working his casting up himself or not. I should advise consultation with any respectable mechanic, whose estimate should be compared with a second, and perhaps a third. Do not trust to any but a capital workman. If you must make it yourself, and expense is a serious consideration, application to the Editor will result in your being presented here, in Amateurs in Council, with in-

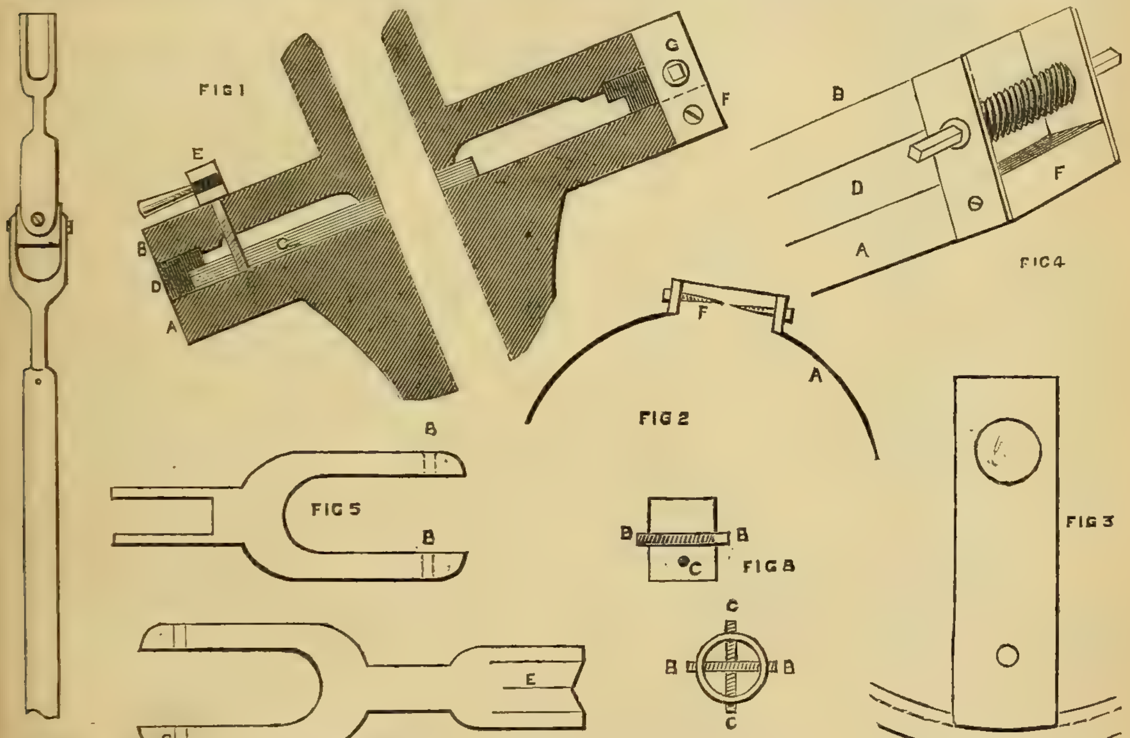


FIG. I.—ATTACHMENT OF APPARATUS TO STAND. FIG. 2.—PROJECTION CARRYING WORM SCREW. FIG. 3.—PLAN OF METAL TONGUE. FIG. 4.—ARRANGEMENT FOR CARRYING WORM DRIVING SCREW. FIGS. 5, 6, 7, 8, 9.—DETAILS OF A HOOK'S JOINT.

the polar axis, works loosely upon the gunmetal ring, so long as the screw E is not tightened; for the piece of metal, C, lies loosely, and moves around under D. But directly the screw E is tightened, C (by raising D) clamps B and D together, and the telescope (which B carries) can then be only moved by the worm at G. If the counterpoise weights have been carefully balanced, the slightest turn of the screw G will suffice to move the whole mass of the instrument with astonishing ease. It will be noticed that the little projection, F, to carry the worm screw should be cast on to A, as shown in Fig. 2. Fig. 3 is a plan of the metal tongue, C. Fig. 4 gives a view of the arrangement for carrying the worm driving screw. The screw is worked by means of a recessed key attached by a and construction of the Hook's joint, shown in Figs. 5—9:—Fig. 5 is a brass casting fixed to long wooden handle. Figs. 6 and 8 show a piece of stout brass tubing, length as breadth, carrying two rivets, B and C; the rivet B fastens Fig. 6 to the casting

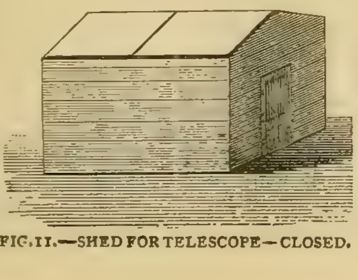


FIG. II.—SHED FOR TELESCOPE—CLOSED.

structions for a much simpler mounting. The pattern of the casting B, Fig. 1, which carries the polar axis, remains as shown in Part 63, Fig. 106, where it is lettered D.

As for the observatory. The Editor already has invited me to write thereon, and as soon as my pen is sufficiently disengaged, I will do so: meanwhile remember this, that, for a reflector, the model observatory would be one which permitted the freest circulation of air, so that tube, mirror, man, and air would be as nearly as possible of equal temperature. Any rough-and-ready contrivance, such as the shed shown open and closed in Figs. 10 and 11, which will shelter the instrument from rain, and the roof of which might be thrown back or removed, will serve capitally for a temporary observatory.—E. A. F.

Varnishing Chairs.

J. H. E. (*Shepherd's Bush*).—The papers entitled "French Polishing in all its Branches" are devoted exclusively to a consideration of this subject. I judge from the heading of your letter that you must be thoroughly acquainted with the process of varnishing, as applied to chairs; and if you are inclined to write on this subject, I daresay many readers will be glad to have any advice and instruction you may be inclined to give them.

Short Taper Tap.

TREADMILL.—If you will go to Holtzapffel and Co., *Charing Cross*, they will show and sell you a proper tap in a long handle specially made for the purpose. Lathe makers in general do not seem to supply these taps, nor do they understand them.—J. L.

Automatic Toy Making.

NOVICE.—You will, I think, find the book you want in "Toymaking for Amateurs," by the Rev. James Lukin, one of the contributors to this Magazine. It contains instructions for the home construction of simple wooden toys, and of others that are moved or driven by weights, clockwork, steam, electricity, etc. Its price is 4s., and it is published by L. Upcott Gill, 170, *Strand, W.C.*

Ink in Dresden.

STADT DRESDEN writes:—"You may be incredulous that good ink cannot be had here, but everybody complains of the stuff, and those who can afford it send to Paris for ink." [Messrs. H. Morell and Co., Ink Manufacturers, 68, *Hatton Garden, E.C.*, are willing to send good ink to Dresden if you will recommend a bookseller or stationer who will undertake to act as their agent.—ED.]

Cutting Fretwork, Etc.

S. EDWARDS, 40, *Goldhurst Road, Finchley Road, N.W.*, will be happy to do any fret-cutting, carving, or blocking-out; and will also fit up and finish amateur's work of any description. If not too large or heavy, goods could be despatched and returned by parcel post.

INFORMATION SUPPLIED.

Magic Lantern Effects.

FAT writes in reply to GIBRALTARIAN: "The simplest and best method of producing the effect of a rolling curtain is to cut a piece of cardboard the exact length of the space from the bottom of one slide to the bottom of the other, when they are in position in the slide holders, and sufficiently wide to well cover the pictures. Now place a slide in the lower lantern, having a handsome crimson curtain painted on it with the Royal arms in the centre (I got mine from Carpenter and Westley), and another slide, the first of the series you are going to exhibit in the upper lantern. Place the piece of cardboard in front of the upper slide behind the object glasses, so as to hide the upper slide entirely; then turn the lights out, and the curtain will appear on the screen. After the opening address, tinkle a little bell and slowly lower the cardboard over the lower slide. The curtain will appear to roll up, disclosing the first picture as it does so. The effect is marvellous, the edge of the cardboard being in front of the slide is out of focus, and makes the illusion complete. At the close of the entertainment, reverse the mode of working, and the curtain will appear to drop over the last picture. The bare disc should never be shown under any circumstances. Of course this plan only suits what is called the bi-unial lantern, but it might easily be adapted to lanterns placed side by side."

Bird Cages.

TREADMILL writes in reply to G. E. D. (*Manchester*), page 228:—"I have been an amateur cage-maker for some years, and have always made my cages according to the French method, which is light, strong, and very handsome in appearance. The bottom is of wood, with four legs, as shown in Fig. 1. In the legs at A, B, C, D, are holes about half an inch deep, into which are inserted uprights of wire, F and G.

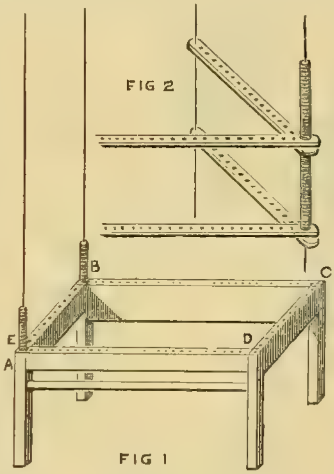


FIG. 1.—BOTTOM OF BIRD CAGE.
FIG. 2.—SPIRAL WIRE SUPPORTS FOR TRANSVERSE BARS OF CAGE.

The frame of the cage is then formed with cross pieces of wood of the requisite length, with holes at the ends through which the wire uprights pass. To support these cross pieces, when the cage is being wired, as also for appearance' sake, spirals of wire (E) are placed between, as in Fig. 2, which will perhaps explain this. Made of polished walnut and tinned ware, with glass all round the lower part, as in English cages, the result is very satisfactory. I shall be very happy to give a detailed account of my ways and means, if required."

INFORMATION SOUGHT.

Portable Turkish Bath.

R. H. (*Dover*) writes:—"Can any of our amateur friends advise me how to make—giving details as to quantities, sizes, and dimensions—a Wooden Portable Vapour, or Hot Air, or Turkish Bath, as made by Messrs. Ellis and Co, *Farringdon Road*, and sold to many of the noblemen by them. I have found them extremely good in rheumatism, skin diseases, and colds, etc., and wish to make one for my own use. I fear it is useless asking the makers for the favour." [A writer, whose name is tolerably well known in the literary world, wrote to me some time ago volunteering information on this very subject. I accepted his offer, and from that day to this I have heard nothing further from him.—ED.]

American Twist Drills.

A. F. C. (*Bombay*) writes:—"I have a set of American twist drills, but find a difficulty in using them with brass. The smaller sizes work well up to $\frac{1}{4}$ inch, but the larger invariably catch into the work. Can any reader of AMATEUR WORK help me over the difficulty?"

Cheap Black Varnish.

GROOVED BARREL writes:—"Can any reader give me an easy recipe for making a good black and cheap varnish, such as is used in black varnishing small lathes and such machinery."

Launch Engine Boiler.

H. H. D. B. writes:—"Will some reader —OLLA PODRIDA, for instance—kindly give me a design for a launch engine boiler, suitable for a $\frac{1}{2}$-horse launch engine, single cylinder, $2\frac{1}{2}$ in. bore, $3\frac{1}{2}$ in. stroke? Would $\frac{3}{16}$ in. BB iron be strong enough for shell and firebox, boiler would have to work at 40 or 50 lbs. per square inch to develope above power? Would this engine drive a boat 15 ft. long, 4 ft. 6 in. beam, and 1 ft. draught of water? What size ought propeller to be, and how are the brass tubes, etc., in a boiler prevented from eating away the iron by galvanic action? I want a design of easy construction, and would prefer a vertical to a horizontal one. Of course, I intend to get the plates sheared and rolled for me, but I think I will fasten the crowns of shell and firebox in with rings of angle iron, instead of having them flanged, will this weaken the boiler anything to signify, and what pressure ought boiler to be tested to? I have a forge for heating the rivets in, etc. I must apologise for giving so much trouble, but I have no books on the above subject."

Steel Plate.

STADT DRESDEN asks:—Where can steel plate, the same as is used for making the frame work of "Acme" skates, be had?

Oil Cans.

H. J. W. (*Newport, Mon.*)—Can any fellow-reader kindly tell me what size the bodies of oil cans are made, beginning from one pint up to two gallons, or if they know of any book that does? should like to know price of same, if possible.

LETTERS RECEIVED UP TO MAY 4.

R. W. W.; J. S.—Replies to queries not yet received from those to whom queries were sent. TRIO.—Reply in next Part.

GROOVED BARREL; RICHMOND; H. S.; NIL DESPERANDUM; R. G.; VIOL DI GAMBA; R. U. (*Dalton-in-Furness*); REV. JAMES LUKIN; BRITANNIA COMPY.; C. H. (*Neath*); MR. EDWINSON; S. O. B.; C. A. P.; EDITORIAL; THOMAS; H. S. W. (*Newport, Mon.*); W. F. (*Leeds*).

HOW TO MAKE A LAWN-TENNIS RACQUET.

By C. T. S.

IN adopting the above title the writer does not claim the following description as the best or proper method of constructing a racquet; he merely attempts to describe how he succeeded in making one. It is not expected that the following instructions will enable anyone who has never seen a racquet to make one. Those people are now few and far between, and are not likely to make the attempt, consequently many little details of measurements are not given, as they are quite unnecessary to anyone having a model beside him to work from. If anyone is anxious to make the effort, and determined to succeed in the construction of a racquet, the writer's advice is, get one of the best made racquets to work from, and, by carefully studying the details of its construction as they are successively reached, especially in the putting together, finishing, and stringing, he will get on better by laying this article aside, thankful perhaps, in a small way, for the details and suggestions in the following paragraphs, the ideas of which are entirely the writer's own, and were only perfected by him after two months' work in leisure hours, during which time he failed sixteen times to steam and bend a bow successfully, though never doubting that success would eventually crown his efforts, in which he was not disappointed, after he had adopted the methods hereafter described.

FIG. 1.—TEMPLATE OR BLOCK FOR BOW OF RACQUET.

To begin with, the special appliances necessary are simple and easily constructed. A steaming box, a template or block, and a press to force the wood round the template into the form of the racquet, are all that are required. The steaming box may be made out of ½ inch pine, 3 feet 6 inches long by 1½ inch square inside, the sides being screwed together, with a thin layer of red lead between, and the ends should be left open, as it is only necessary to steam for bending the three feet in the centre of the wood forming the bow of the racquet, the extremities forming the handle not requiring to be bent. The template should be made out of 1 inch pine to fit into the centre space of the racquet, shaped as Fig. 1. The form of this template can best be found by tracing the curves from the inside of another racquet, the curves at AA being intensified or cut to follow the dotted lines, which will allow for the spring-back, when the pressure hereafter described is relaxed, to let the wedge of dark wood into its place in the centre of the handle. The construction of the press, Fig. 2, will be better understood by referring to the nut-cracker of daily use, from which it has been copied. It should be made out of pitch pine or other strong wood. The two arms are about 5 feet long by 7 inches wide, and are fastened to a cross-piece A, let into them at the top, with strong wrought iron flap hinges on the outside, a space 1 inch wide being left between them. The length of these arms is required to get the necessary leverage or power to force in the curves of the racquet at AA. The template, Fig. 1, is now placed on the pieces forming the press, Fig. 2, with its head resting on the cross-piece, A, care being taken that a line drawn down the centre of the template corresponds with an imaginary line down the centre of the space between the two arms, and a curve is drawn round the template ⅝ of an inch from it, which will correspond with the outer line of the finished racquet. The surplus wood outside this line must now be cut out of the arms and cross-piece, which will let the template into its place, forming a channel round it ⅝ in. wide, in the exact form of a racquet, and in this position the template and cross-piece A of the press should be firmly screwed down to the floor of the workshop. These special appliances having been constructed satisfactorily—and to ensure a good result they should be carefully made, and the sides of the press and template made truly parallel—the making of the racquet itself may now be proceeded with.

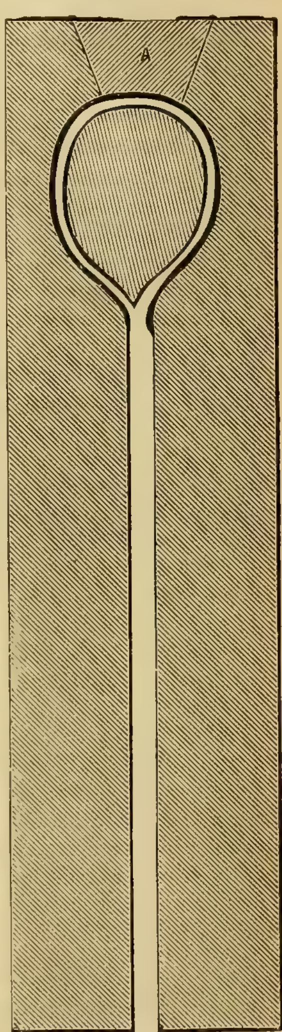


FIG. 2.—PRESS FOR FORCING THE STEAMED WOOD ROUND BLOCK IN FIG. 1 INTO FORM OF RACQUET. NOT DRAWN TO SCALE.

The timber usually employed for making the bows of racquets is English ash, the American ash being

quite unsuitable, but racquets are now in the market made of hickory, as well as those made of ash and cane combined. The strip of wood required should be 5 feet 6 inches by 1 inch by $\frac{9}{16}$ inch, which will allow for dressing down and finishing. The best racquets are made out of wood that has been cleft or rended out of the tree to follow the run of the grain, but, as obtaining this may be a matter of difficulty for most amateurs, unless they can make friends with a racquet maker, the following plan may be followed. Take a plank which has been cut out of the centre of the tree, with the grain near the bark running nearly straight from side to side. Discarding the $\frac{1}{2}$ inch of timber nearest the bark, which is not generally sound enough to be trusted for such a severe bending operation, the plank should then be worked on its edge from the centre with a small plane or spokeshave, till a grain or growth is reached running right across (the grain alternates in brown and white layers, which is easily followed) ; this should be traced till at least 3 feet 6 inches has been cleared to form the bow in the centre ; the run of the grain in the handles is immaterial and need not be followed. The strip about $\frac{3}{4}$ inch thick may now be sawn off the plank, and the corresponding 3 feet 6 inches on the sawn side worked down to the grain, as on the first side, till the strip is $\frac{9}{16}$ inch thick, when the edges may be planed square with the sides, and the strip hung up to dry for at least two or three weeks, this is important, as the wood when green will almost certainly burst under the pressure of bending, and the preparatory work be lost. It will require some care to get the wood to the required dimensions, and if it has been well done, the run of the grain on the one edge will correspond with that on the other, at least through the 3 ft. 6 in. of the centre of the strip, on which depends so much of the success in bending.

The strip of wood being dry, we are now ready for the steaming, but before commencing the strip should be marked on the inside of the handles (the inside of the strip to be the inside of the bow, being that which grew nearest the heart of the tree), and a pencil mark is also required to show the exact centre of the bow, which should be put into the press exactly opposite the centre of the cross-piece A. This marking must all be done before steaming, as no time can be spared for it afterwards. The part of the bow to be bent should now be bound round with twine or flat linen tape, to prevent it bursting in the process of bending, and it should not be wound too tightly, as the swelling of the wood in the steam might break the twine, in which case the wood in bending would, in all probability, also burst or open at the place where the twine broke. The strip of wood may now be placed in the steaming box, with the pieces to form the handles protruding at each end, and steam may be supplied from an ordinary kitchen kettle, through an india-rubber tube, securely wired on to the spout, and after filling the kettle scarcely so high as the top of the outlet, the lid should be wedged down with an india-rubber band round the flange, to prevent the steam escaping except through the tube into the box. The tube may now be inserted into the end of the box, under the strip of wood, and the openings at each end well packed with rags. The steaming process with these appliances will take about an hour and a half, which will necessitate the water in the kettle being replenished at least once during the operation ; the cessation of the steam will give warning that the water in the kettle is all but done.

Before leaving this part of the subject, an alternative process to the steaming of the wood, from which, perhaps more satisfactory results may be obtained, should here be described, and this consists in boiling the wood in water. The principal difficulty in this case is to obtain a vessel sufficiently long to take in a length of five or six feet. This can be found in an ordinary rain water-pipe, which can be bought from any builder for two or three shillings, the most suitable size being six feet long by three inches diameter. One end must be stopped up with a plug of wood and red lead, care being taken to see that it is perfectly water-tight, and any little holes in the pipe from defective casting should also be plugged. It is necessary before boiling (and probably would be an advantage in the steaming process also) to steep the strip of wood in cold water for four or five days, and this can be done in the pipe. Before doing so, the pipe must be cleansed, to prevent the discoloration of the wood, as a cast-iron pipe, whether new, or old and rusty, will, when water is placed in it, turn the water red, which will stain the wood. This can be prevented by first boiling the pipe full of water with two or three handfulls of lime or soda in it. When all is ready, the pipe should be filled with hot water, and placed in an upright position against the ribs of a strong kitchen fire, where it will soon boil, when the strip of wood should be put in and boiled for an hour.

When the strip of wood is taken out of the steaming box, or boiling water, no time must be lost in getting it into the press, whose arms should be extended ready, at right angles to the template, and as soon as the strip of wood is entered in the channel at the cross-piece A, the arms must steadily be brought together, and secured with a clamp or other catch, in which position it must be left for a day to set. Rarely is a piece of wood submitted to this severe bending process without some sign of fracture, either at the inside curves, A, A, or at the outside curves on the top of the racquet. The advantage of the binding with

string is that it prevents the burst opening up, and it can generally be worked out in the finishing. Of course, this is an amateur way of doing it, as, no doubt, professionals can bend the bow satisfactorily without binding it, but they will not generally be willing to impart the information as to how it is done.

After the steaming process the wood dries or seasons rapidly, and is fit to work next day, but not so after boiling. In the latter case the bow should be bound tightly at the neck round the template, now unscrewed from the floor, and put in a moderately hot place, such as a hot water cylinder cupboard, for a week to ten days, when it should be thoroughly seasoned.

The wedge of wood in the centre of the racquet-handle is generally made of 1 inch walnut, all in one piece, a coarse file or rasp being of much service in getting out the curves. This piece is also occasionally constructed of three pieces, the curves being got out of two separate pieces, which have been previously glued on to a fillet of walnut about $\frac{5}{16}$ inch thick, and in this latter way the sides of the fillet are more easily planed parallel. In fitting this piece into the racquet, commence by putting a screw nail through the other two pieces of the handle and the wedge at the butt end (the length of the strip of wood, 5 feet 6 inches, will allow about an inch and a half to be cut off the butt after the handle is glued together), and with the rasp the curves at the head of the wedge can then be got to fit tightly on each side without removing the screw. The various sides to be glued should now be roughened with the rasp, and with the glue very hot and thin the handle may be put together. Le Page's carriage glue will be found very suitable for this, as it gives plenty of time for manipulation before it sets, but it must be laid aside for at least two days to dry. Several clamps are required for this process, as the glued curves at the neck must be put together with great force. The sides of the handle should be clamped together, only moderately firm at first. The wedge of walnut should be cut about half an inch shorter than the other two strips forming the handle, and the fore part of a strong iron clamp should be applied to the round front part of the wedge, while the back part, or base of the clamp, rests against the other two strips of the handles. On applying the screw the wedge will be forced back into the handle till the curves at the neck commence to open, when another clamp must be applied at the neck to force the curves together again. To prevent this clamp slipping down the curves as the pressure is applied, two small fillets of wood should previously have been glued on at the bottom of the curves, in fact this had better be done so soon as the bow is taken out of the press after bending, as it will assist the binding round the template during the drying, and they can easily be removed with the chisel and scraper before polishing. The brass screw may now be put through the neck, and the point filed down.

The two pieces of cedar wood may next be got out for the front and back of the handle—the handle itself should now be roughened to receive them—when they may be glued and pressure applied till dry. The handle should be planed so as to show eight sides, this being better and less liable to turn in the hand when in use than the oval form. It should now be reeded with the rasp or scratch, and the butt end cut to the finished length and the leather put on.

We now come to the drilling of the holes in the bow for the stringing, which should be done before the scraping down and finishing. The number of holes required is 76; they should be carefully marked round the inside of the bow, where they all appear in the centre, or equidistant from each edge, alternating right and left in their direction towards the outside. The position of each hole should be carefully marked from another racquet, from which it will be seen that eight of the holes require to be slightly larger than the rest, to allow of the cross stringing entering the same holes as the stringing lengthways. The holes can most easily be drilled in a lathe, but, without one, they should first be pierced with a small sprig-bit from the inside, afterwards being enlarged with the brace and twist-bit from the outside. Channels should be made on the outside of the bow where the stringing traverses between the alternate holes, care being taken to start between the right pairs at the top; this protects the stringing from tear and wear, and allows the strip of leather on the top to be glued on quite flat. Before commencing to drill the holes be sure to see that the holes for the cross stringing on the one side are exactly on a level with the corresponding holes on the other side.

The racquet may now be fined down with a scraper, and all the twine marks, etc., eradicated, till the desired weight along with the stringing is obtained; it should then be well rubbed with glass-paper, and receive two coats of clear spirit varnish.

Before stringing the bow, it will ensure success if a press be made to prevent it being drawn out of shape in the process. The following press is easily made, but the details are not illustrated, the article having been recently patented; any amateur, however, may make one for his own private use without infringing the patent. It consists of two discs or templates, a shade larger than Fig. 1, with their edges bevelled to fit the finished bow; they should be made of American walnut, about $\frac{5}{16}$ of an inch thick when finished, and green baize glued on to the insides and edges; crosses for each disc of the same wood, about

1 inch by $\frac{3}{4}$ inch, and long enough for their points to project beyond the discs, which should be flush with the edge, on to the edge of the bow, should be screwed to the discs, and a hole for a screw sash fastener, about 3 inches long, made through the centres of the crosses and discs, the nut being screwed on to one of the crosses. When the fastener is firmly screwed up, the points of the press resting on the edge, and the bevelled edges of the discs pressing against the sides of the bow, effectually prevent any warping.

The gut for the stringing costs about 4s. 6d., and may be bought from any racquet dealer. The 18 strands lengthways are in one piece, and the 24 cross ones in another, the thin cross gut for top and bottom being in a third. The long strands should first be laced through all their holes without straining them tight. Commencing at the top, pass the two ends of the one piece of gut downwards through the two centre holes, and lace them through the proper holes till the ends come out at the outside of the ninth holes from the centre of the wedge in the handle, where they are fastened by being passed underneath the loops formed by the strands already laced. This fastening can, of course, only be completed after the stringing is drawn tight, but before this is proceeded with the press must first be applied, with one of the discs unscrewed and left off, which will enable each strand to be seen as it is drawn tight. Two small pegs should be temporarily tapped into the top centre holes, and when these strands are drawn sufficiently tight, they should be secured with similar pegs at the bottom holes, and this process should be followed throughout, the strands being drawn tight alternately from the centre to each side. If the fingers are too delicate for this operation, sufficient strain will be got by passing the gut over a piece of wood, from which the edges have been rounded off, or, better still, thrust the wood into a piece of india-rubber tubing, which will effectually protect the gut from harm. The cross stringing is commenced at one of the top curves, the end of the gut being fastened with a knot on the outside, which prevents it being drawn through the hole; it is laced and strained tight one strand at a time till it comes out at the end of the twenty-fourth strand, where it is fastened by being knotted and drawn into the next hole by the thin piece of finishing gut which commences here. This cross stringing will tax the patience and skill to the utmost, but perseverance will overcome the difficulties.

The polishing may now be completed with white French polish, and with a fine camel-hair brush, the gut, which will generally have a chafed and rough appearance, should also get two coats of polish, two days' interval being allowed between each coat.

A few hints on the construction of racquets made of ash and cane combined will close this already too long article. The strip of ash wood required is as before described, but only $\frac{3}{8}$ inch thick, and a previous failure with the bursts worked out may come in for this narrower measurement; the piece of cane should be of similar dimensions, but perhaps $\frac{1}{16}$ inch thinner will do. It is got out of a Malacca cane, about $1\frac{1}{2}$ inch in diameter, which will supply cane for two racquets. It should be sawn or split down the centre, and carefully planed to the required size, which is easily done. The two pieces may be steamed and bent together, and the binding with twine dispensed with, as the ash in the thinner size is more easily bent. The press or the template must be cut to increase the size of the channel between them to $\frac{3}{4}$ inch. The simplest way is to make a new template, but this will, of course, reduce the finished size of the racquet. After the two pieces are set, they may be glued together; commencing at the top of the bow, glue about 6 inches at a time, tightly binding them together with twine, when a further 6 inches may be done in the same way till it is all completed, when they should be put back into the press to ensure them retaining the proper shape.

From the details it will be seen that there is no difficulty which an amateur cannot surmount in making a racquet, provided he can obtain the proper timber for undergoing such a severe strain of bending. This, in fact, is the only difficulty, and it is only a waste of time to commence working on wood that is not known to be fit for the purpose, such is all timber found in the plank in a timber yard: avoid it unless it is newly sawn, and sufficient of the bark left to show that the tree has been well grown; in that case a six feet slab or outside plank, without a fault or growth from it, might do. Wood benders, of whom there are some in every large city, might oblige an amateur with suitable timber, if he has not the advantage of living in a part of the country where ash grows, but if he does, let him make friends with a forester, who, for a few shillings, will obtain for him the very best article for the purpose that can be got.

THE OVAL CHUCK: HOW TO MAKE IT.

By LOIDES.

BEFORE the invention of the oval chuck, the production of true ovals was a matter of great difficulty, but by its aid we can turn ovals in the lathe with almost the same ease as circles. This useful piece of mechanism was invented by William Murdock, the assistant of the celebrated engineer, James Watt. It

happened one day that he called on Matthew Boulton, the partner of James Watt, in the firm of Boulton and Watt, seeking employment, and during the interview, not knowing what to do with his hands, Murdock employed them in fingering his hat. Boulton being struck by the singular appearance of this article, enquired how he became possessed of it. Murdock answered, "Oh! I just turned it in a bit lathey of my own makin';" and Boulton thinking that a man who could turn a

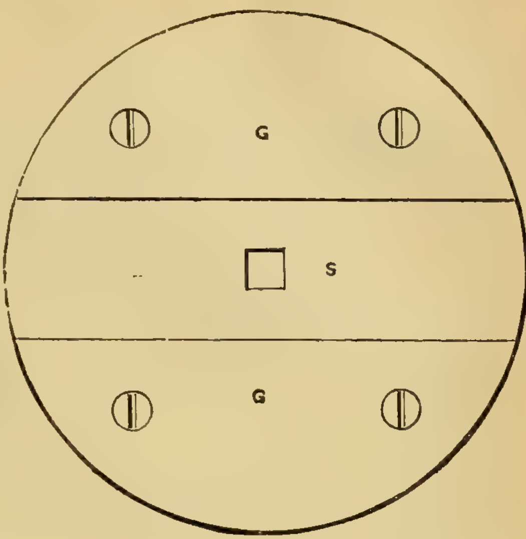


FIG. 1.—FRONT VIEW OF OVAL CHUCK.

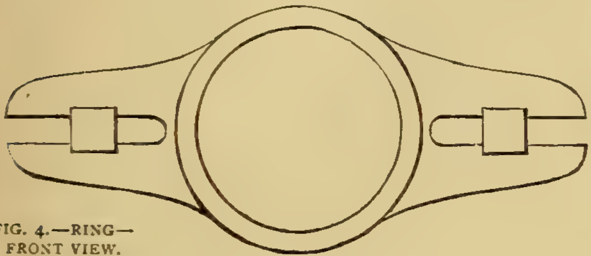


FIG. 4.—RING—FRONT VIEW.

FIG. 5.—RING—SIDE VIEW.

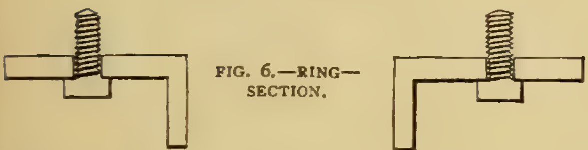


FIG. 6.—RING—SECTION.

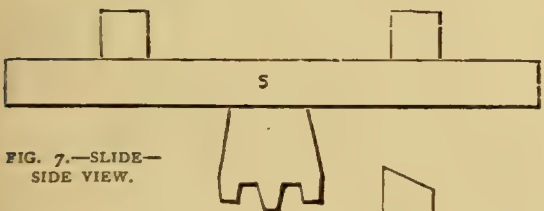


FIG. 7.—SLIDE—SIDE VIEW.

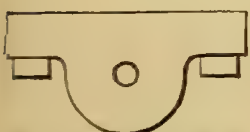


FIG. 9.—CASTING TO WIDEN LATHE HEAD.

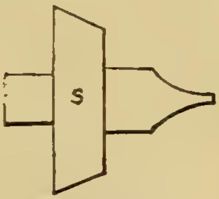


FIG. 8.—SLIDE—END VIEW.

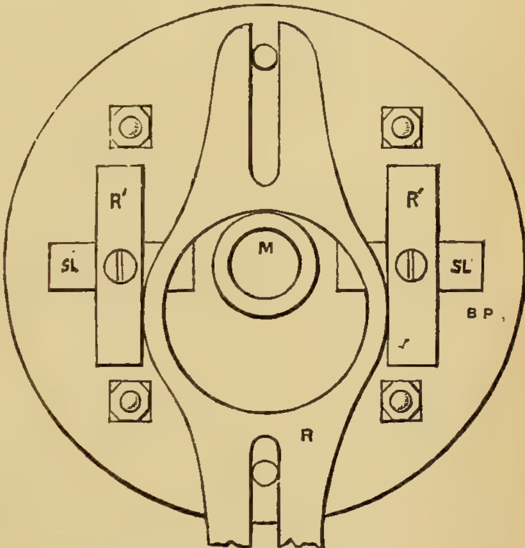


FIG. 2.—BACK VIEW OF OVAL CHUCK.

hat in a lathe of his own making, was worth having, told him to call again the next day, and he would see if he could find him something to do, for he had just said to him that at present they did not want any men, but believing him to be a man of considerable capacity, he was unwilling to let him go elsewhere.

Murdock remained with the firm of Boulton and Watt a great many years, and became the superintendent of the engineering department, at the modest salary of £1 per week.

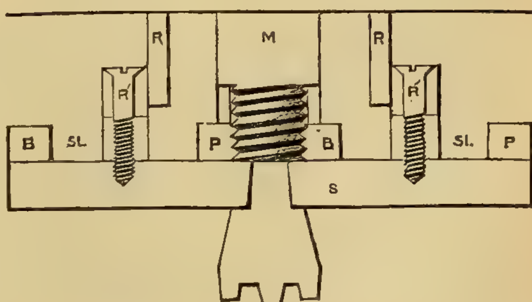


FIG. 3.—SECTION OF OVAL CHUCK.

However, this is not describing an oval chuck, so I will stop. The oval chuck consists of a slide (S, Fig. 1) carrying two rubbers (R', Figs. 2 and 3), which are fastened to two studs cast on the back of the slide, which work in two slots in the back-plate of chuck, which is screwed on the nose of the mandrel. The slide is moved between two guides (G, G, Fig. 1) by means of the rubbers clasping a ring (R, Figs. 2 and 3), which is screwed on the face of the lathe head eccentric with the mandrel, as Fig. 2; when the mandrel is made to revolve, the slide carrying the work is moved nearer to the chisel every half revolution, and consequently the chisel cuts more off the two sides of the work which are opposite to the ends of the slide, thus producing an oval or ellipse.

I think the drawings, which are all half full size, together with this short description, will explain themselves, but for the benefit of those who are not very skilled in metal work, I will give a description of the manufacture.

The drawings are my own design, and are not from any of the sets of castings sold by manufacturers, such as the Britannia Company, so those who prefer to purchase one of those sets will have to work to them, but the principle is always the same. Those who do not get a set of castings will have to make their own patterns, and get castings from them. The ring should be of brass, but all the rest iron.

The best wood for pattern-making is baywood or mahogany, but pine is generally used because it is cheaper. We will commence with the ring, Figs. 4, 5, and 6. Cut a piece of wood $6\frac{1}{8}$ inches by $2\frac{5}{8}$ inches by $\frac{1}{4}$ inch, and cut to shape shown in Fig. 4, which is 6 inches by $2\frac{1}{2}$ inches by $\frac{3}{16}$ when finished, and then get a piece $2\frac{3}{4}$ inches square, and 1 inch thick, and turn it into a ring $2\frac{1}{2}$ inches diameter outside, $\frac{3}{4}$ inches wide, and $\frac{1}{4}$ inch thick, making it rather thicker at one edge than the other, so as to draw easily from the sand, and glue it on the first piece, then cut out the centre of the first piece, and also the grooves at each end.

Next take two pieces $5\frac{3}{4}$ inches square and $\frac{5}{8}$ inch thick, and turn them into two discs $5\frac{1}{2}$ inches diameter, one $\frac{1}{2}$ inch, and one $\frac{3}{8}$ inch thick; in the latter cut the two slots, SL, Fig. 2, $\frac{3}{4}$ inch from the centre, and $1\frac{1}{2}$ inch long, and $\frac{1}{2}$ inch wide. Cut a parallel piece out of the centre of the $\frac{1}{2}$ inch thick disc, $1\frac{1}{2}$ inch wide on one side, and 2 inches on the other, so as to form a dovetail slide, as Figs. 1, 7, and 8, and glue on the wide side two studs $\frac{1}{2}$ inch cube, $1\frac{1}{4}$ inch from the centre, as Figs. 7 and 8.

For the chuck as described, the lathe head will require to be 5 inches wide across the face. If it is not of this width, I should make a small pattern, as Fig. 9, and get two castings off it, and screw them at each side of the lathe head.

Now varnish all the patterns and take to the founder's. Having got good castings, we will commence work on the ring, as the other parts have to be fitted to it. File up the flat portions, edges, and grooves, and then clamp on the face-plate of the lathe, and turn the circular part inside and outside and on the edge, then get two set screws about 1 inch long and $\frac{5}{16}$ inch diameter, then draw a line across the face of the lathe head parallel with the bed, and through the centre of the mandrel, and drill and tap to fit the set screw's two holes, one on each side of the mandrel, $2\frac{1}{8}$ inches from the centre. Next turn a small collar or washer $\frac{3}{8}$ inch long, and the same size as the shoulder of the mandrel, as Fig. 3, bore and tap to fit the mandrel, the plate with the slots in, then screw on and turn both sides true; first turn one side, then take off, turn round, and screw on the mandrel with the turned side towards the collar, and turn the other side. Then file up the broad side of the slide perfectly true, and file both edges parallel to each other, then face up one side of each of the two guides, and file the edges to the same bevel as the edges of the slide, so that they will fit together; the slide must be ground with fine emery and oil when the chuck is fitted together, so as to be made to fit perfectly, for on this depends, in a great measure, the quality of the work done. Then file up the two studs on the back of the slide, taking care to have them exactly in the centre, and then file the slots in the back plate, so that the studs will just work easily in them, the slots must also be exactly in the centre.

Bore and countersink two holes in each guide, as in Fig. 1, and bore corresponding holes in the back plate, and then bolt the guides to the back plate, and screw it on the mandrel, and turn the face of the guides, making them a little thinner than the slide will be when finished, so that work that is screwed on the slide will work freely past the guides, then put the slide in its place, and face it up, and also turn the edges of the chuck. Then screw the rubbers (R, Figs. 2 and 3), which are simply pieces of $\frac{1}{2}$ inch square iron 2 inches long, on the studs on the back of the slide, so that the ring will just fit between. Next fit a spur centre in the slide, as Figs. 3, 7, and 8, and countersink the hole at the back so as to take a stout screw to be used in fastening short work on the chuck. And now put the ring on in its place, and screw the chuck on the mandrel, and it will be complete.

The chuck, as described, is for a lathe with a mandrel 1 inch diameter, mandrel nose, $\frac{3}{4}$ inch diameter, and $\frac{3}{4}$ inch long and projecting $1\frac{1}{2}$ inch from the face of the lathe head, but the dimensions may be

easily altered to suit any lathe. I will also just mention that the oval and eccentric chucks may be combined, by fastening the latter on the slide of the former, when very beautiful work may be produced, such as ovals intersecting, oval inlaying, etc.

The reader will have remarked that in the above description of the method of making an oval chuck, and of the parts of which it consists, reference is not made to all the letters which appear in the diagrams with which the description is illustrated, and lest anyone may imagine that this is an omission, it will, perhaps, be desirable to call attention to the fact that the letters used are the initial letters of the parts of which the chuck consists, and show these parts in each diagram in which they are inserted: thus, S, wherever it occurs, is the slide; G indicates guide; R, ring; R′, rubber; SL, slot; BP, back plate; and M, mandrel. With this brief explanation I may now bring my remarks to a fitting close.

ELIZABETHAN FURNITURE.

WITH PRACTICAL HINTS ON ITS CONSTRUCTION.

By Rev. ALGERNON THOROLD, M.A.

IV.—THE MODE OF CONVERTING AN OLD CHEST AND OTHER MATERIALS INTO A NEW CABINET.

(*For remainder of Illustrations, see Folding Sheet issued with this Part.*)

SOME of the pieces of the bedstead which fell into my hands are shown in Figs. 10, 11, and 12. "Capital dry firewood," most people would have said, and so it would have been, only I knew a better use for it. Amongst my old stores I also had the front of an old chest. Fortunately, it was similar in length to a fine and genuine Elizabethan cabinet, which served for my model, and was exactly what was required for the lower front of the one I was putting in hand.

The panels were plain, and the rails and stiles were well moulded in flats and hollows. This piece of panelling is shown in Fig. 9.

Let us suppose that you have some old oak—panels, rails, stiles, perhaps an old chest or two—which you do not care for, and other such odds and ends; and all the better if it should so happen—some squares of panelling, as shown in Fig. 9, which have done service in the top or back of a bedstead, or a door. You hardly know what to do with them, but you think you could make up something if you had a model or drawings from which you could work.

This being the case, it is impossible to do better than to take Figs. 5 and 6, or Fig. 1, for a model, and turn your old pieces into a valuable cabinet. We must begin in order.

It will therefore be necessary, first of all, to dissect the model, that we may thoroughly know what suitable old oak we have, and what we shall want.

Fig. 13 shows the lower front of the cabinet taken to pieces. In it we have two rails, A A; two stiles, B B; two side rails forming the front legs, C C; two panels, D D; a door, E; and a shelf, G.

Fig. 14 shows the upper half of the same cabinet. In it we have two rails, F, P (this P should be F in diagram); four stiles, G G; one sunk panel and frame, H; two doors, K K; one top cross-rail, I (see Fig. 22); two columns, L L; a cornice, M; and a slab, N, for the top of the cornice.

Fig. 15 shows one side—both sides are alike excepting that one is right handed and the other left. In it we have one long rail, O O; a side rail, as shown at C C, in Fig. 13; four stiles, P P; three panels, Q Q; and columns as shown in L L, Fig. 14.

Of course, it is only too probable that our store of old oak may be at vanishing point before the demand upon it for so many rails, stiles, and panels can be supplied; and, even if we have a sufficient number of the various pieces, they may not match in design, although they are right in measurements. It will be better that the stiles and panels should be in pairs, at least, if possible, but if all are different we must do the best we can in their arrangement.

Having overhauled our stores, we may proceed to make a list of our deficiencies.

Plain lengths for the rails will answer our purpose equally with pieces that have been "worked"—the carving and moulding can always be added; this also applies to panels. The great thing is to have plenty of real old oak at hand. New wood must be avoided excepting for the back, even though we have to wait in our work.

Before commencing work it will be well to study Fig. 16 with some attention. It shows the cabinet in skeleton—that is, as it appears in frame-work, when all panels, back, and inside shelves have been removed.

All necessary measurements have been given, but only as a model. In making up old oak we must, more or less, go on the principle of cutting our coat according to our cloth. All the measurements, therefore, may be altered at discretion; only it will be well to remember that those given are in right proportion to each other, and therefore the remaining measurements should be adjusted to any important modification of the scale suggested. We must make up our minds, to begin with, what changes are required, that we may utilize our materials to the best advantage. Any sudden change of plan in the middle of the work

will probably land us in confusion, and spoil both the appearance and symmetry of the cabinet.

Having come to a decision on these points, we must make a rough working drawing of the cabinet skeleton, with the measurements we intend to adopt.

Now, if by chance we have amongst our stores the front of an old chest, it will make a capital basis of operation—provided, of course, it is of the size required ; but, even if right in length, there is little doubt that the side rails will be too short, as it is exceptional to find chests standing so high as the lower front of our cabinet in Figs. 5 and 6. Turn it over and knock out the pegs, which are somewhat conical, the small end being at the back. When pulled apart, give these pieces and all the other odds and ends we propose using a thorough scrubbing with hot water, black soap, and American lees. This process will remove all old beeswax, varnish, dirt, etc., and leave the wood with its original surface. When dry we shall probably look at it with some dismay, its white and uninteresting appearance being considerably at variance with anything like orthodox old oak ; but to this we need pay no attention, as a soaking with oil at a future day will restore the true colour and silver threads of the grain.

Taking the measurements given in Fig. 16, we find that the side front rails of the cabinet are 2 ft. 5¾ in. in length: these are 1½ in. in thickness.

At first sight it may seem less trouble and better to make new side rails and altogether discard the old ones, which probably are several inches too short ; but as we can hardly hope to excel the old mouldings, or to make anything like such mortises as in the rails to hand, we shall do much better by carefully piecing on such extra lengths as we may find necessary to bring what we have to full length. To rectify the deficiency, prepare two short lengths of old oak, the grain running the long way of the wood, taking care to cut them a few inches longer than really required.

The joints by which we must fasten on these supplemental legs are, at first sight, a little intricate ; but there is no real difficulty about them, provided we go to work with care. They are on the half-joint principle, with the addition of internal tenon and mortise joints. These latter are absolutely needful to prevent the pieces breaking away from each other in case of a sudden blow.

Fig. 17 shows in isometrical perspective the joints we have to make.

Fig. 18 gives view showing positions of mortise and tenon as they must be cut.

The joints of both the pieces to be fitted together are cut to the same measurements. Cut the long rail half way through, on the moulded side, four inches from the lower end. Turn it on edge, and remove the piece shown in the dotted lines, Fig. 19. This is technically known as a halved joint.

Then proceed to cut a tenon as shown at A, Fig. 18; this tenon may either be centred as shown, or should the rail be a thin one, it may, by preference, be kept flush with the inside of the rail, at X ; this done, cut the mortise, as shown at B, Fig. 17, which must carry the tenon (similar to the one just made) of the supplemental leg to be fastened on. Of course, if the tenons are kept flush with the inside of the rail, the corresponding mortises must also be altered.

These alternative tenons and mortises are shown by dotted lines in Fig. 17. Now take the shorter piece, or supplemental leg, and treat it in the same way as already described for the long rail.

Care should be taken to make the tenons fit tightly into the mortises, as the strength of the joint lies in the accuracy of this part of the work. When fitted to our satisfaction they may be glued up, the two pieces being brought together, end to end, as closely as possible, with a cramp, if one is at hand.

It will also be an advantage to screw the parts together from the back, but see that the points are not likely to protrude in front, before they are put in.

When dry, clean off the glue, but any moulding or carving which may be requisite on the new lengths can be postponed for the present.

On reference to Fig. 14, we see that the panels are of equal width, but on turning to Fig. 16 we find that the two side ones only are alike in this respect, and that the centre part occupied by the door is considerably larger. Our next step must, therefore, be to alter the position of the stiles, B B, Fig. 20, which will be effected by cutting new mortises in the upper and lower rails.

Fig. 20 shows the skeleton front of the cabinet; B B are the stiles in their required position ; C C, in dotted lines, are the stiles as they appeared in the chest front before alteration.

Fig. 21 shows the edge of the upper and lower rails; A A, the mortises; H H, are the new ones required to be cut ; P P in dotted lines are the old ones; M M is the groove carrying the panels. When the new mortises have been cut we must fill up the old ones, P P, and also such portions of the grooves as lie between the two new mortises in both rails. Strips of old oak, which must be carefully glued in, should be used for this purpose.

Should it happen, however, that no such chest front, as described, is in our possession, we must look round for materials to supply the deficiency. Old rails taken from some other panelled work will next best meet our requirements, but lacking even these, we must procure such old oak planking as we can, and make what we want for ourselves.

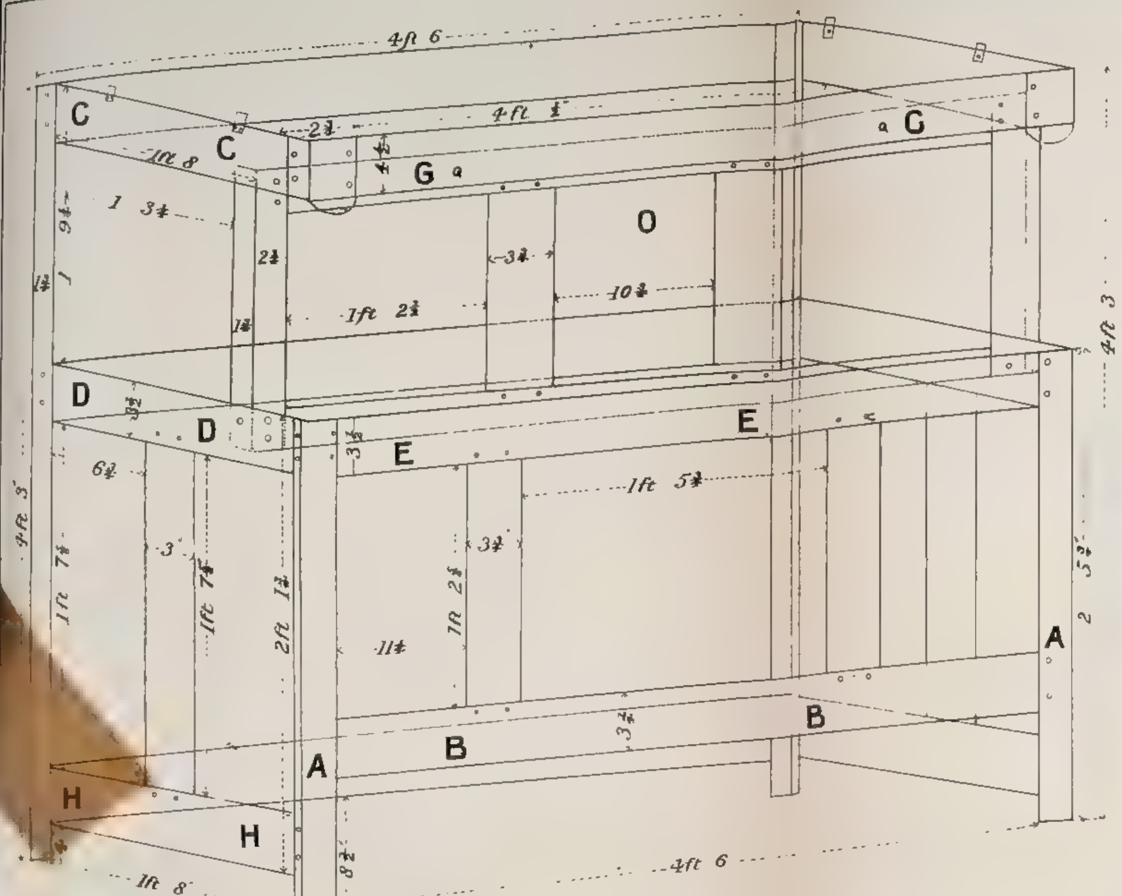


Fig. 16.—Cabinet in Skeleton.

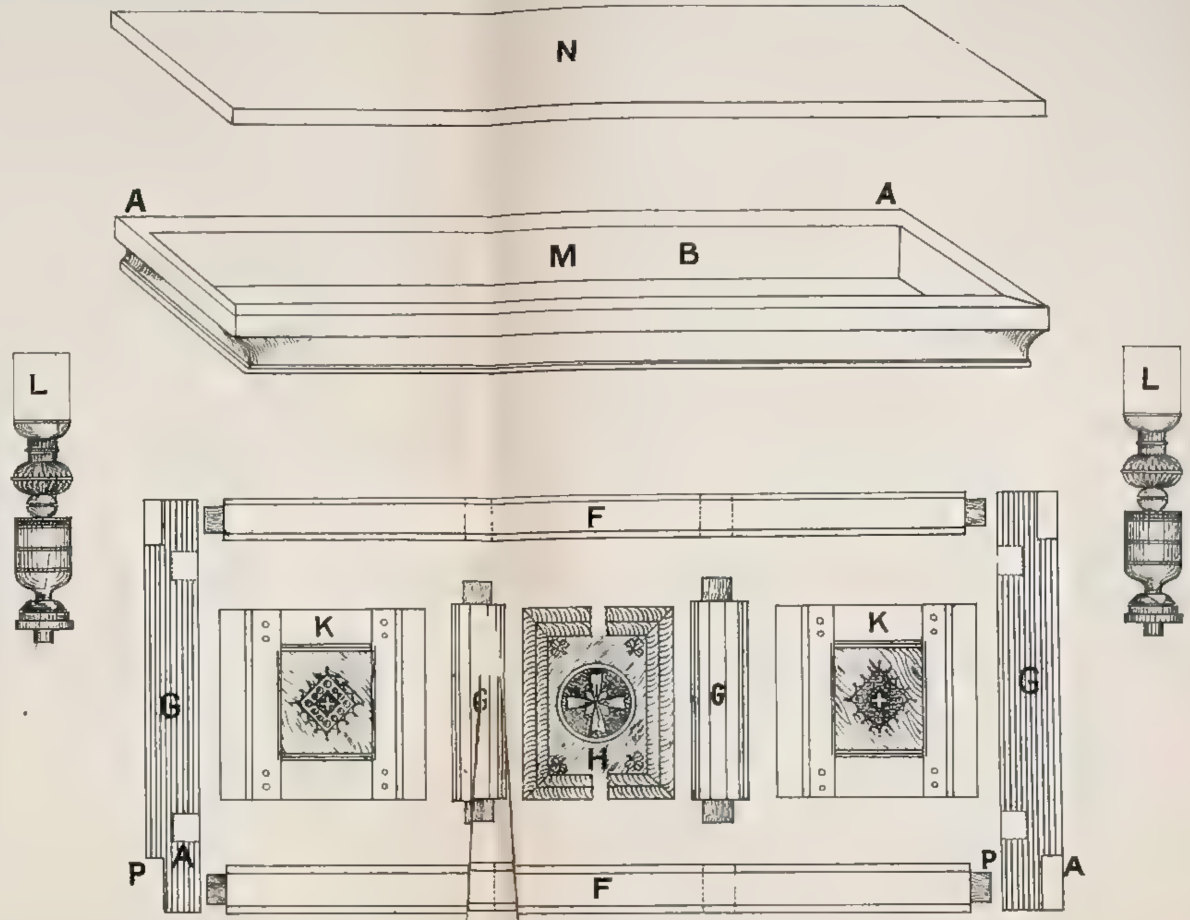


Fig. 14.—Upper Half of Cabinet in Pieces.

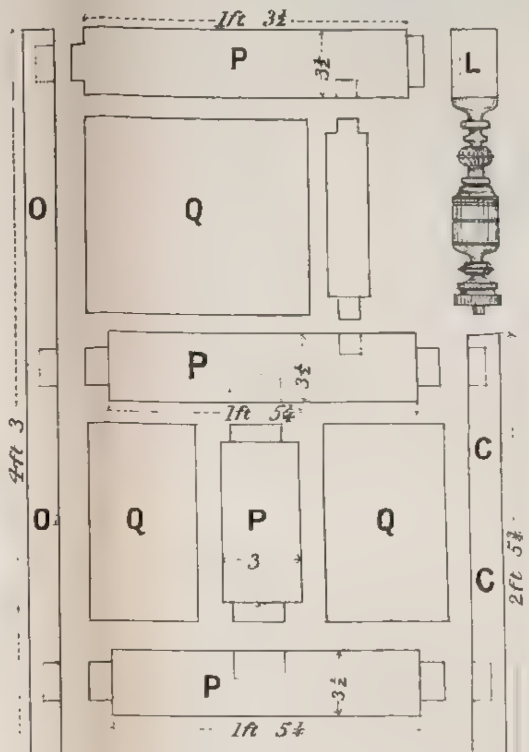


Fig. 15.—Side of Cabinet in Pieces.

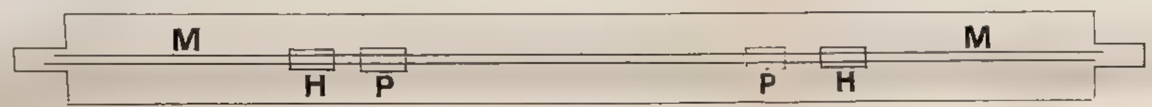


Fig. 21.—Edge of Upper and Lower Rails.

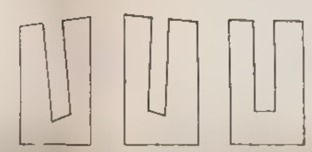


Fig. 25. Examples of Good and Bad Grooving.

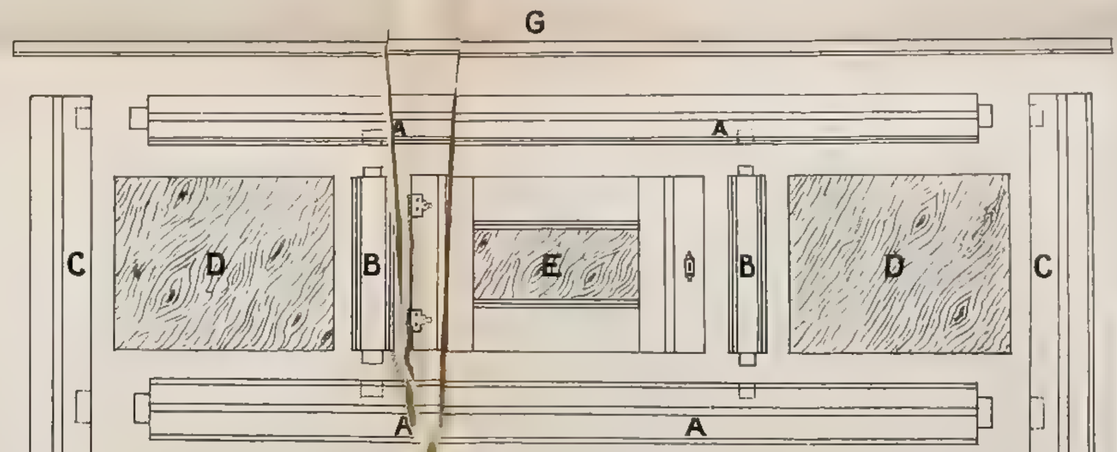


Fig. 13.—Lower Half of Cabinet in Pieces.

Fig. 26. Oaken Peg.

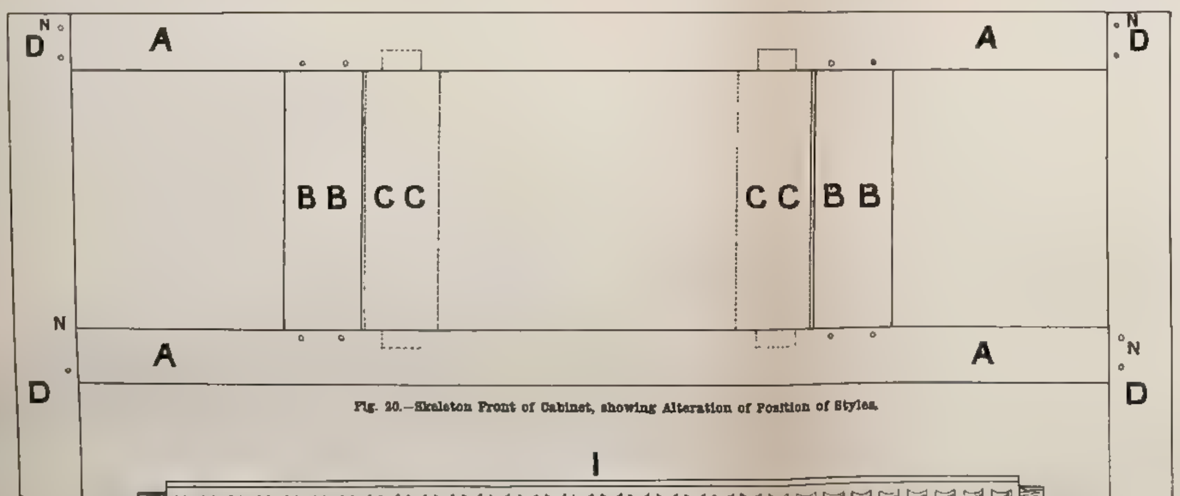


Fig. 20.—Skeleton Front of Cabinet, showing Alteration of Position of Styles.

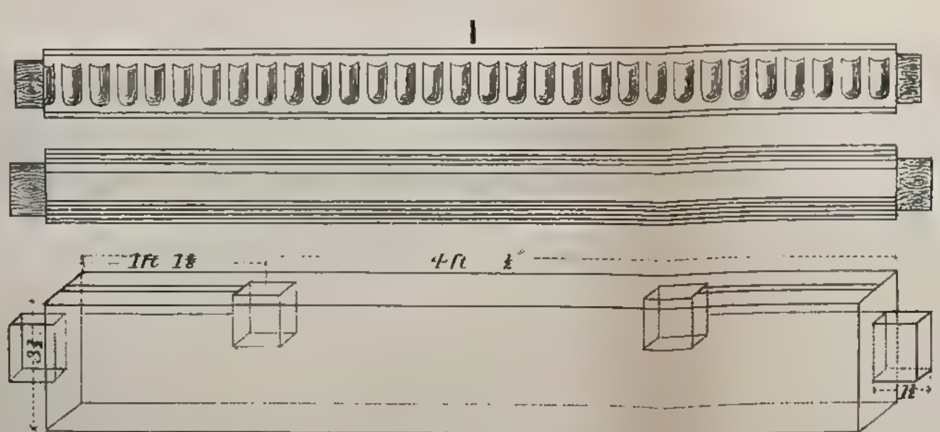


Fig. 22.—Cross Rails of Front.—Elevation and Perspective View showing Mortises and Tenons.

A CABINET

CONSTRUCTED OF PIECES OF OLD CARVED OAK,

IN IMITATION OF

Elizabethan Furniture.

Drawn and Described for "AMATEUR WORK, ILLUSTRATED,"

BY

ALGERNON THOROLD, M.A.

Fig. 19.—Formation of Halved Joint.

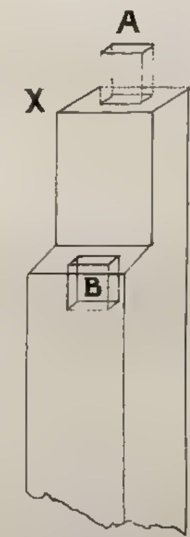


Fig. 17. Mode of Jointing.

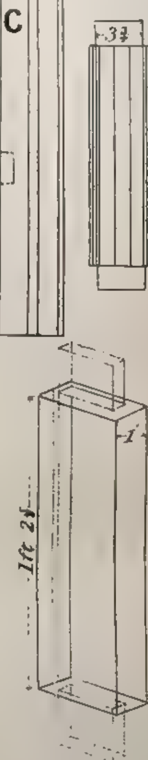


Fig. 24. Style of Front. Two Views.

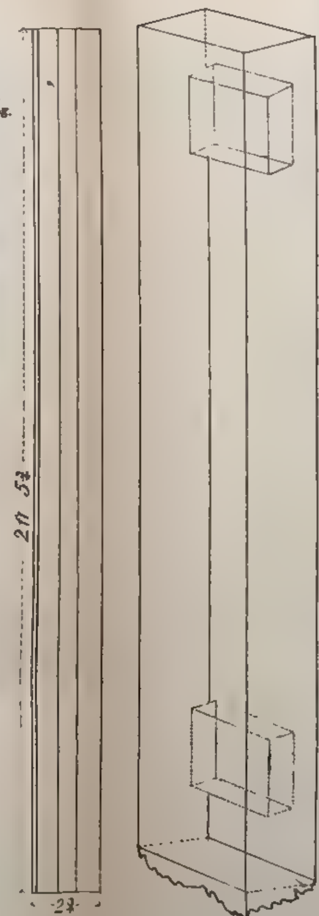


Fig. 23. Side Rails of Front. Two Views.

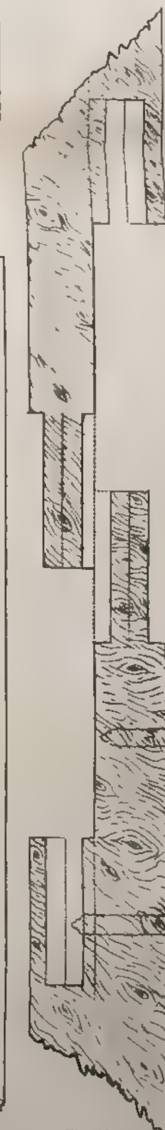


Fig. 18. Diagram showing Relative Position of Mortises and Tenons, as they should be cut.


H

In this case we must aim at $1\frac{3}{4}$ inch stuff for the side rails, and 1 inch stuff for the long cross rails and stiles. Figs. 22, 23, 24 will give all the measurements we need.

Old planking, and we must not hide it, is rather dangerous to our tools. A hundred and fifty years ago workmen were not chary of their nails, and as it is a good deal easier now to drive them further into the wood with a heavy hammer and a punch than to pull them out, most special directions ought to be given for their proper removal when ordering our supply. Before we start upon any old planking or beams, a very careful examination should be made for these rusty enemies, time spent in this way, though the job is a tedious one, is well paid back in the damage spared both to our tools and tempers.

Having selected the best wood we have, we must rip out slips according to our measurements for the requisite number of rails and stiles; all these should be carefully planed up, and the edges accurately shot. This last is an important point, for unless the edges are true and square, the grooves to be cut by the plough will follow the cant of the edge, whichever way it may turn out of the level, causing annoyance and trouble when the panels are dropped into their places. Fig. 25 will show this, and the wrinkle is worth

FIG. 10.—CARVED BEDPOST.

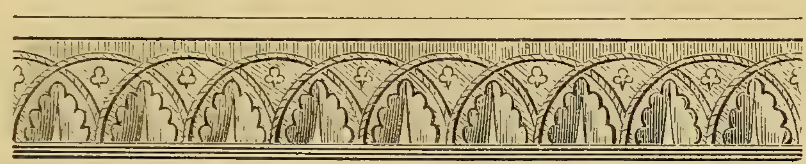


FIG. 12.—CORNICE FROM OLD CARVED BEDSTEAD.

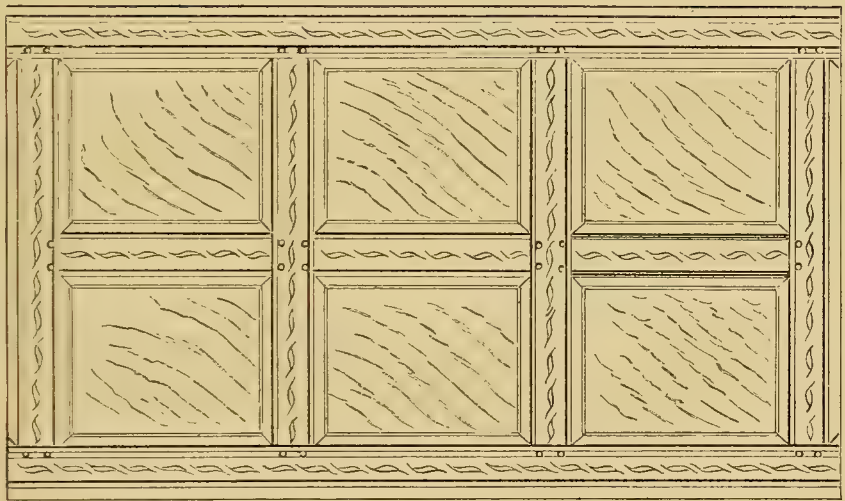


FIG. 9.—PIECE OF OLD OAK PANELLING.

FIG. 11.—CARVED BEDPOST.

remembering in work which requires the use of the plough, especially in all sorts of tonguing.

The strips of oak being prepared, mark and cut out the tenons and mortises in the rails and stiles to the measurements given in Figs. 22, 23, and 24. These figures are drawn plain, and, as can be seen, are not in exact proportion, the thickness of the wood being unduly increased to show the grooves and mortises with greater clearness. The same measurements as given in Fig. 22 can be applied to both the long rails, those in Fig. 23 to both the side rails, and those in Fig. 24 to both the inside stiles. The edges, however, of the long and side rails in which the mortises are cut will face each other when the front is put together. Two of the panels which were taken from the chest front may now be cut smaller to fit the narrower openings in the cabinet front; it will be advisable to leave the carving of any design upon them which we may have in mind, and all such similar work as may be required until the cabinet is otherwise complete. When the panels are fitted in, the whole front may be clamped together and temporarily pegged up, as shown at N N, in Fig. 20; the pegs, Fig. 26, should be cut out of stave oak, and of sufficient length to admit of easy removal.

(*To be continued.*)

OVERGLAZE PAINTING ON PORCELAIN.

By AURELIO DE VEGA.

XV.—LANDSCAPE—WATER—SKIES—FLESH—CONCLUSION.

259. "'TIS DISTANCE lends enchantment to the view." And this it does in a variety of ways, the principle of all of which, however, is the impression created by the whole instead of the part. Softness of outline takes the place of sharpness; roundness appears where, in reality, ruggedness is; a flowing contour, instead of point and peak; mass instead of detail; and, generally, in the absence of direct bright light, soberness of tint instead of brilliancy, with a general tone instead of play of colour. The poet is right, too, when the mountains appearing clad in azure, he makes distance their clothier. But mountains and other very distant objects are not always azure. Except in those cases when, as at sunset, much coloured light is reflected from, say, water, or snow or ice-clad tops, or craggy uplands, distant objects are almost always grey in hue—that is, they are rarely of a full pure tint, but the hue is always more or less clouded, the cloudiness being caused by the intervening (generally semi-opaque) atmosphere. Hence, on a fine evening, the vapour in the atmosphere condensing with the chilling earth, even middle-distance may appear nearly white. It is only when the air is quite clear (generally before a storm) that we see distant objects quite distinctly, and in their natural colours, but then the effect of distance is lost, and it is remarked that they appear quite close. This results from the absence of the usual concomitants of distance, as indicated above, and hence we deduce that to indicate distance we must observe those characteristics.

260. In the matter of colour, also, a corresponding modification must be made, and it will be found that the colours most suitable are those which either are opaque in themselves or become so on mixture. Thus, tile, orange (of the palette), the purple arising from blue and carmine, or any blue and a gold-red, pearl-grey, black-grey, the green-grey arising from mixing blue and yellow, and so on; and these should be used only in medium, or less than medium tones. Generally speaking, the paler the tone the more distant is the effect.

261. Foreground Drawing and Colouring.—In the foreground, on the contrary, the objects being well in view and at hand, the characteristics as to drawing and colouring are the reverse of those obtaining (except under sun-influence) in the distance. Hence here we have sharpness of outline, detail, and all characteristic touches—rockery, stones, roadmarks, shrubs, leafage, trunk-graining, etc.; while life of any kind may give scope for effective treatment. The colours may appropriately be bright, rich, and deep. They will, in any case, correspond more with the natural colours of the objects themselves, and of whatever colour this may be, they may be of as full tone as is requisite. Here, too, there may even be scope for absolute purity of colour, and this not merely in touches.

A few notes as to suitable colouring for the more commonly occurring special objects, not otherwise dealt with, will probably be useful, and will give an indication as to others.

Rocks.

Red. Brunswick toned with Vandyk or chocolate, shaded sepia.—*Brown.* German, toned with Vandyk. —*Sandstone.* Pale German, streaked for red with a mixture of scarlet and a touch of chocolate. If necessary, glaze with pearl-grey pale. — *With Seaweed.* Fleck with Gordon, and shade green.

Trunks of Trees.

Generally. German and sepia, alone or mixed; orange will be useful for sunny effects.—*Plane.* Olive brown, toned as may be required with German or roseleaf, the disbarked parts with yellow, toned with olive green.—*Silver Birch.* The markings with pearl-grey, and flecks of black laid with stiffish colour and a dryish brush.—*Mountain Ash.* The reddish parts with Brunswick.—*Mosses* give scope sometimes for brilliant colouring, and pink, carmine, yellow, Berlin yellow, Vandyk, and Gordon may often be required pure. Pearl-grey and the same mixed with a very little of the other colours is frequently most useful for self tints and glazing.

Roads.

Chalky. Pale pearl-grey. — *Granite.* Pearl-grey with German and a touch of neutral grey.—*Gravel.* A mixture to be determined by experiment of yellow with Brunswick in excess, glaze for markings with a suitable brown and grey-black.

Banks.

Earthy. German brown, darken with sepia, lighten with yellow or touch pearl-grey with it.—*Sandy.* Same as gravel roads.

262. In the middle distance the objects of all kinds require due delineation; but occupying a middle place, they begin to show distance by losing perfect sharpness of form; and as for colouring, the various greys with tones accommodated to the natural hues, find place for the most part.

WATER.

263. Still water is always done with a wash. It should not be dabbed, but always flatted with a brush,

and these washings should almost always be perfectly horizontal. Water is rarely absolutely flat, however calm it may be, and the brush lines are best for giving the effect of the slight motion. Such water will reflect whatever may be above it, both as to form and colour, and hence may have any or no markings, and any colour. Thus, a river under a glowing sun may appear a sheet of unbroken rose tint, or glisten like molten gold.

264. Water with a slight ripple may also reflect form and colour with points of light. The general washings will again be horizontal; but particular markings, as the *wash* of a boat, or the roll of a wave will, of course, take their proper line. Sparkles or streaks of light will be picked out with the soft wooden point or rag; and, if coloured, will be filled in with the appropriate colour.

265. IN DEPICTING WAVES the brush should do all that is required, and the set of the wave must be shown by the brush markings. For this purpose the paint may profitably be a little thick and oily, so that the brush work may be apparent in it. Crests of waves and foam may be picked out, but often it will be found that a dry brush will be most useful in doing this, as it will easily give irregular and frothy clearances. Similarly in rolling waves coming in to shore, the brush may best make the gradation in depth on the under side of the breaker.

266. WHERE TREES, SHRUBS, HOUSES, OR OTHER OBJECTS ARE REFLECTED, the general tone of these will be washed in; and where the tints of the water and of the object reflected join, the paint may have a little oil of lavender to secure softness of line. It will be observed that, except in the very stillest water, the reflection has not a regular outline, but this is jagged, or rather quivery. Perpendicular markings in darker parts, as for reflected lights breaking through bushes, may best be done with a brush nearly depleted of colour.

267. AS FOR COLOUR, but little need, I think, be said specially. *Clear Water* will always partake more or less of the blue above it, whether near or distant. Where the reflection is good, the tone will be, in general, a trifle below that reflected.—*Turbid Water*, when not fully showing a reflected colour, will, of course, have a self-tint, which may be influenced according to its stillness by reflected colour. For reflected trees, a little shadow green added to the colour above will be useful; while for other colour, a touch of black-grey or of pearl-grey, according to darkness or lightness of tint, will generally prove sufficient. For a very common turbidity, the greenish grey produced by mixing azure and yellow is good. A brownish grey is well made by pale German with a touch of yellow and roseleaf green. For sea-side sands, one cannot well get a much better colour than a mixture of German and Vandyk.

SKIES.

268. Where the sky presents a broad stretch of colour, this will be washed in boldly with a broadish brush, the colour being made a little open with a drop of oil of lavender. If the tint is—as it will most frequently be—a graduated one, it may be laid so, or dabbed, as the paint dries, a little heavily on the lighter part. In the case of a sky with antagonistic colours, say blue above and yellow below, it will, perhaps, be safer for the beginner to do one colour first, then fire, and then do the second; but even in the case supposed, a little practice will enable him, with properly prepared pigment, to *work in* a very pale shade of yellow on the lightest part of the blue—that is, intermix the thinnest tints of both—without producing any greenish effect.

269. A full wash may also be given where one colour is to predominate, to be afterwards broken up by clouds. The clouds should be clearly outlined in Indian ink before painting commences, and when the paint is laid they may be taken out. For this purpose a very useful tool is a stump shaped as for crayon work, and made of loosely rolled soft, thick blotting-paper. This will make nice soft edges, and is extremely handy in small work, where complete cleanness is desirable, or for cumulus clouds. For cirrhus work a combination of stump and nearly, or almost, dry brush, is good; while for a sky of the "mackerel" kind, a dryish brush is all the requisite assistance.

270. Care must be taken where the wash colour is to be replaced by one which would be injuriously affected or impaired by mixture with it, that it is very cleanly removed, so as to reveal the polished ware beneath; and it is preferable that when the parts to be differently coloured are cleaned, the painting should be thoroughly dried before such colour is laid; the new colour must then be very cleanly laid on, and it is better that it should be a little "dry." In this way a "bit of blue" may be inserted in a leaden sky without deterioration of the purity of the azure, or a band of crimson in a setting of gold. With some colours the addition of a little glaze is good.

271. As to colour, the notes to be found in Sections 210 to 220 on Mixtures, will furnish numerous indications; but one or two remarks may here be appropriately made. Let the lower part of the sky, indicating the extreme distance, be devoid of any obscure grey in depth, or of dull, heavy character, except, of course, for special effect; slightly opaque colouring, in a pale tone, produces generally the best effect. For rich sunset effects, amber will afford the best means of giving golden clouds. For

fine oranges, of more or less pure quality, use carmine and yellow; these tone down well with Berlin yellow, which leans towards chestnut. The vermilion of the oil-painter is not reproducible, but at a little distance the effect is wonderfully well simulated, if only lines are required, by placing scarlet and *rouge brun riche* (Lacroix), in juxtaposition, the latter as a mere edging. Note that scarlet must not touch amber, or it is "killed." For rich crimson effects, more powerful than are afforded by carmine, which cannot be used thickly, add a little purple to the carmine; while for the madder brown, fleecy clouds, so charming in some skies, a little chestnut or Vandyk added to carmine is very serviceable. Such a green as Sèvres pure is perhaps rarely to be found in skies, although it has appeared on occasions which were, perhaps, exceptional; but a greenishness arising from touching blue green with Sèvres is not so uncommon, and is, in a suitable surrounding, highly effective.

FLESH.

272. We come now to the delicate subject of flesh work, delicate in more senses than one. The depiction of flesh tints, with any approach to truth to nature, is, in any kind of painting a task of difficulty, one in which success is obtained by but comparatively few, and the results of the efforts of these few are not always equal. In china painting, owing to the colours principally concerned, difficulties, non-existent in the sister branches, are introduced in the nature of the ware, and in the action of the colours on one another under fire; and in the manipulation of the yellows, reds, and browns, lie some of the chief obstacles to success in this line, so far as colour is concerned.

273. It may be said that there are two leading schools of flesh painting—the English and the continental. Much of the work of the former is, to a large extent, only a slight advance on monochrome work; while, as an illustration of the class in which the latter appears to the greatest advantage, may be mentioned the realistic work of the Viennese artist, Carl Schmidt.

274. The efforts of the English school are, for the most part, given to work of the decorative style, which takes broader treatment, more appropriate to the subjects, which are mainly large heads and busts on circular or oval earthenware plaques, less frequently full or three-quarter figures, in about a quarter of life size. More lately, too, large mural pictures have been executed, in which the painting has been done on fitted tiles of some 6 inches or so square, and large painted panels have even been employed in the decoration of exteriors. In all these, delicate flesh tints are, from the nature of the case, less demanded than excellence of composition and generally harmonious colouring. The general tone of the flesh in these may, for the moment, be described as a warmish light brown, more or less reddish or yellowish, with a little of a darker brown, or a suitable grey, mixed therewith, or separately used for shadow. Such a scheme presents the basis of most of the work of this class. The monotony which might be expected from such a scheme, is relieved by the free employment of colour in the accessories—in the hair, both in itself and by introducing flowers or fruit, or in the drapery, with further colour on the rim of a dish or in the background, which may be foliage or tapestry, or, perhaps, landscape. But while there is full scope as well for the display of special technical skill in the matter of painting, as for the highest artistic treatment in the matter of form and arrangement, and the general effect is unquestionably excellent, there are many who would question a claim on its behalf to be regarded as high art, in so far as this may have as its aim the holding of the mirror up to nature at its best.

275. In the continental work of the kind referred to, a very decided effort has been made to reproduce actual flesh tints, and has been attended with a high degree of success, especially in some of the work of the above-named artist. These are really studies in flesh work. A very large proportion are on oblong *porcelain* plaques of foreign make. These, with the exception of some which have a special object such as a candle-light effect, exhibit largely the appearance of a painting on ivory, which arises from the initial lines of the colouring. Although the colouring is frequently strong, the effect is generally delicate and markedly realistic. I do not include in this reference to continental work, such flesh tinting as is to be found in small figure subjects on vases or other ornaments or on most modelled figures—all in the Dresden style. In these, the flesh tint is for the most part given with a wash of red or *rouge chair*, simply strengthened for the cheeks, etc., and darkened slightly for the shadows, and the touches are, to put it mildly, not delicate. In work of the Sèvres style there is considerable improvement on this last procedure, and a nearer approach to the style more particularly described, which is still further approached in large heads and busts.

276. It is sometimes alleged that work like Carl Schmidt's cannot be produced in England. This is, of course, comparative. In fact, it is only a matter of expense and of conciliation. If, on the one hand, painters would select the dearer ware, and be willing to pay the increased charge which would have to be made, having regard to the increased care and attention to be given to the pieces in firing, and the different style of firing, and, on the other hand, the

kilnmen, would be a little less exclusive and more accommodating, there does not appear to be any sufficient reason why the difficulty at present existing should not be satisfactorily arranged. At the outset, it would be a matter of give and take. A comparatively high charge for firing would probably have to be made and endured at first, but with the convenience afforded the demand of painters for its employment would increase—there would be satisfaction all round, and there would be a home school, producing work which need not fear competition with any that might be placed against it from abroad.

277. For the ordinary style of painting, the scheme of colouring is, as already indicated, comparatively simple.

278. First, however, one cannot insist too much upon the absolute necessity for a firm and complete outline. In work which is to be mainly decorative, a visible outline is, in certain cases of broader and more simple treatment, permitted, as adding force to and emphasizing the characteristics of the subject. This outline is of a stronger tone than any of the tones used in the flesh, and should be clean, fine and vigorous. To this end it may be drawn in with a vitrifiable ink. When the outline is not to appear in the finished work, in which the features are to be the result of the modelling of the colour and the contrast of the background, the outline may be in Indian ink, and should be fine so as to avoid absorption of the colour which might show hard after firing.

279. FOR A GENERAL WASH over the face, neck, arms, and hands, a colour frequently employed is Vandyk, but this is a trifle crude; a much preferable colour is one composed of Vandyk and German, with the excess, if any, in the direction of the Vandyk. In flesh work, it will be found expedient to use the colour rather more open than in other branches, inasmuch as the results are better and clearer, when various tints are blended, than when any washes that have to be modified are first allowed to dry. For this the addition of a little fat oil or a drop of oil of aniseed will answer. *The ruddiness of the cheeks*, nostrils, lips, and elsewhere is, in this scheme, furnished by red or *chair* (Lacroix), touched with Brunswick or some similar iron red such as *rouge brun riche*, a very rich and easy colour to work, or by Pompadour, which is a nearer approach to blood red, but is less easy to work with other colours, requires more care in firing, and is more expensive. *The Shadow* is procured by deepening with Vandyk pure or with a little sepia, while a grey, which is extremely useful in the half tones, may be composed of blue-green, a touch of carmine, and a little grey black. This gives a very neutral grey, which will take a suitable brown tone perfectly. Occasionally a little chocolate is effective.

280. THE PROCEDURE is to lay a wash of the general tint, leaving the cheeks less heavily covered, as also the rosier part of the ear. The eyes are then to be taken out. On the cheeks, work in the selected red with a fine brush; towards the margin crossing and recrossing with the point of the brush, so as to thoroughly incorporate it with the local tint. If this be done so, and the colour be in proper condition, no brush marks will appear and the colour will fire out beautifully clear and without any boundary lines. *For Smoothness of Colour* dab; starting with the high lights on the forehead and ending with the darkest parts. The object of this is to keep the dabber clear of any colour which would be out of place on that next to be dabbed. The lights on the lip, the line and tip of the nose, and the chin, may first be prepared by lightening the colour with a dryish brush and then dabbing. Be careful not to overdab the cheek-bones, as it makes them appear very prominent, although this of course can be remedied in another painting. *The Lips*, *Nostrils*, etc., should be put in neatly, and I think it preferable that they should be left as laid, the brushmarks sufficiently denoting texture. With well-mixed paint, the outline will easily be made soft, or the outline may be softened with a brush dry from paint, but moist with oil. It is an excellent plan to render the light on the lips in the same way. *As to the Shadows*, it is a matter of skill whether these shall be laid immediately after the general wash, including the heightening for the cheeks or shall be left until the first coat is dry. Whichever course is taken, they must be softened away into the general tint. When the work is small it is best to do this with the painting brush, until some of the moisture is evaporated, and then finish off with a softener; when, however, the work is of sufficient dimensions, the plan recommended by Miss Florence Lewis may be tried. In her work on China Painting (Cassells) she writes, "Dip your dabber straight into the colour and put in the shadows without the use of any other brush. *To do this successfully requires some little practice*, as the effect is very bad if the shadows look spotty. After filling the dabber with colour, always try it on your palette before touching the face with it." The italics are mine, and there is abundant reason for the remark italicised — indeed, the words "not a" might be substituted for the word "some." The practice, however, in the hand of Miss Lewis, whom I have seen employ it, produces beautifully soft results. With regard to the expression "after *filling* the dabber," it needs to be explained that the dabber is not to be filled as a painting brush would be. It is only to be so charged that it will lay the required tint on the ware. A good deal of care must be exercised not to have the work spotty.

281. Another process akin to dabbing, which finds favour with many artists of skill and repute, is using a finger as a dabber. This, too, requires practice, but may soon be acquired. For this let the paint be a trifle less open than for the dabber, and in using the finger a peculiar grain may be given. If at the right stage a softener be used, a texture is produced occasionally very valuable. In much of the decorative work which is exhibited from time to time, there may be observed either too great smoothness or else a grain which resembles nothing so much as elaborate stippling or cross-hatching, quite tiresome to look at.

282. As to *Shadow Colour* one word more. Some writers recommend to keep the shadows rather blue. I do not concur in this advice; blue is a strong colour, and maintains itself in a strong fire, which affects other ingredients of a grey. Any excess of blue tends to make the shadow proportionately cold looking, and I would rather suggest that no more blue should be used in the shadow than is requisite at the outset to produce the ultimate result aimed at.

283. The scheme already given will result in a moderately florid complexion. The complexion will tend to fair if to the Vandyk, or the mixture suggested, a little ivory yellow (*jaune d'ivoire*) be added, and a pale shade be employed. Here it may be observed that the fault of beginners in flesh work is to paint too strongly, the results being crude. At the same time, it must be remembered that in any mixture with yellow and an iron red, the red should be in excess of the colour required, as the fire reduces the red constituent. Experiment alone can determine the proportions and the depth of painting required.

284. FOR ALL FLESH WORK the procedure indicated above will be adaptable. In the cases of arms, necks, etc., the student will be careful to secure the requisite roundness and avoid harsh outlines. An aid in the first respect will be found in removing the work to a little distance, when the general effect of the painting will be more appreciable than when at the ordinary working distance from the eye. As to the second, to take fingers by way of illustration, let there be no visible dividing line, but let the distinction between one finger and another be made out solely by the contrast between difference of tone or tint, and light and shade.

285. FOR A DARK RUDDY COMPLEXION the foundation colour may be as before, but slightly fuller, and with a mere touch of sepia added. The latter is rather powerful, and a good plan is to glaze with it for a second firing. By this means greater clearness is secured. The shadows will, of course, be proportionately dark.

286. FOR A SWARTHY COMPLEXION orange, with olive brown and a little Vandyk, will make a good general wash. There is not much "colour" in this complexion, but what is required may be worked in as before—*rouge chair*, No. 2, being a good colour. If the darkness should have to be somewhat pronounced, glaze, as in the last case, with sepia.

287. THE EYES.—A great deal of beauty may lie in this feature, and a good face may be spoiled by a dauby or unnaturally coloured eye. In eyes of moderate size attention to detail amply repays the trouble taken. A glance at the human eye will show, for example, that the iris is not all of one colour or of one tone; the outer circumference is darker than the inner, and shades off into it, though not always by a regular gradation; and in an eye covering any reasonable space, this distinction should be reproduced, as the want of it gives heaviness to the eye. In a large-sized eye a further detail should be observed, and that is, that the iris is full of radii; lastly, do not forget the bright spot if the eye is not in deep shadow; indeed, there may be a secondary bright spot, according to the lights. *The colours* most frequently required for eyes are blue, blue-grey, and brown. For blue eyes use a light azure, with a touch of tile for variety; for blue-grey eyes tile blue, strengthened as required, and lightened with pearl-grey; for brown, Vandyk or chestnut, touched, as may be necessary, with sepia. One variety of brown eyes is well represented by golden brown, heightened with a touch of yellow. A very beautiful grey eye, most effective in a picture, and not often met with in nature, is made with tile blue, with a suspicion of carmine.

288. AS TO THE HAIR, it does not seem necessary to say more than that it should be laid entirely with the brush, a dabber not being admissible. Curls or waves, after being brushed in, should be brought up by the shadow being painted on with fine touches.

289. THE CONTINENTAL, or more delicate style, manifests itself principally in fair flesh. The scheme for this, as almost uniformly described by foreign artists, is as follows: The general tint is made with *jaune d'ivoire* and a little red in the proportion of two to one, *rouge chair* or pompadour being used for heightening the colour on the cheeks and for the lips, etc. For reflected lights orange alone, or with a little Vandyk; light shadow with a yellow brown, strengthened with some suitable brown Vandyk or sepia; and the deeper shadows with chocolate and blue-green (*vert bleu*), which is equivalent to azure, touched with roseleaf green. It will be seen from this that the scheme is a harmony proceeding from pale warm ivory, the lights being yellowish. In following this line it will be found an improvement to take as a ground colour a mixture of equal parts of

red and yellow, to which is added a little German brown; while a mixture of two parts red to one yellow, although very deceptive in use, works well in with the last-named wash to produce a good young flesh colour rather better than Hancock's flesh.

In bringing this series of papers to a conclusion, I cannot but recognize my duty to render, as well to our Editor as to my readers, my amplest apologies for the delay in completing this labour of love; and the sincerity of my regret will perhaps be admitted when I say that the delay, caused at the outset by extreme pressure of my ordinary work, was rendered the greater by a consequent affection of the eyes, which for a time prevented my using them beyond what was absolutely necessary in my ordinary duties.

(*Concluded.*)

A FOLDING LOUNGE CHAIR.

By ALEXANDER MARTIN.

MANY people have an idea that a folding chair is, as a rule, a nuisance—a thing giving a great deal of trouble for all it is worth. Until I came across the one I propose describing in this paper, I was of that opinion myself, but whoever may make it will, I am almost certain, say when it is finished, that this folding chair is the exception to the rule.

This chair of which I am speaking, and which is shown in the accompanying drawing, is, literally, a lounge chair; for on one's sitting down in it, it at once adapts itself to the position of the sitter; and, what is of very great importance to the amateur, it is exceedingly simple to make. It can be used in three positions, or indeed for that matter, almost any number of positions by simply cutting an additional notch in one of the frames (Fig. 9), to make the inclination wanted. Then it goes into such small bulk when folded up—about 4 feet by 1 foot 10 inches by $1\frac{1}{2}$ inches; in which state it is so very convenient to carry about, being both light and handy, that it may be used to great advantage as a garden chair.

Any moderately strong wood will do for making this article; ash, birch or beech would be quite suitable.

A general idea of the chair may be obtained by examining the small sketches, Figs. 1, 2, 3 and 4. The first shows it in its lowest position; Fig. 2 in its most upright position; Fig. 3 in a position midway between these other two; and Fig. 4 shows it when folded together, standing flat against a wall. A strip of canvas, carpet, bound at the edge, or other strong material, about 4 feet 3 inches long by about 14 inches wide, is fixed to the top rail and the front rail; and it is because this swings quite free all its length, that the chair makes so nice a lounge.

As I have already said, this article is very easily made; but before describing how to proceed, perhaps I had better mention that Fig. 5 is a side elevation of the chair in the position shown in Fig. 1, Fig. 6 as in Fig. 2, and Fig. 8 as in Fig. 3. A front elevation of Fig. 6 is shown in Fig. 7; and all these elevations (Figs. 5, 6, 7 and 8), and also Figs. 9, 10, and 11, are drawn to the scale of 1 inch to the foot. There are four iron pivots required to put the chair together, and on which the movements depend; but the pivot itself is a very simple thing indeed, as will be seen by examining Fig. 12, which is a sketch of it.

The first thing to do is to make the frame shown in Fig. 9. This frame when in position, forms the seat at the front, and slopes down to the floor, on which it rests at the back, see Fig. 6. Two rails are required 3 feet 6 inches long by $1\frac{1}{4}$ inch wide by 1 inch thick; dress them, rounding all the corners off. I may here say that all the pieces used should be treated in the same way, so that no sharp edges are to be found anywhere. A section of these rails is shown in Fig. 13, where it will be observed how the corners should be treated. At one end of each of these two rails, and on one of the *inch* faces, three notches are cut—see Fig. 14, which is a drawing, full size, of one of them. Cut the first notch about 2 inches from the end, the next about $7\frac{1}{2}$ inches from the end, and the third about 13 inches from the end. At the opposite end to that at which the notches are cut, a rail 2 inches by 1 inch by 1 foot 5 inches long is required, dressed up and corners all rounded as before; it should be mortised into the other rails on their $1\frac{1}{4}$ inch faces, and the size from shoulder to shoulder should be 1 foot $3\frac{1}{2}$ inches. At the other end (that is, the end with the notches), a rail 1 ft. 5 in. long by 1 inch by 1 inch, is wanted, the size from shoulder to shoulder being as before, 1 foot $3\frac{1}{2}$ inches, and mortised as before. This rail should have its four corners reduced until it takes the form of an octagon; or it might, if convenient, be turned, and a pin turned at each end about $\frac{1}{2}$ inch in diameter to go into the side rails. This latter would be a much easier way of putting in the rail than mortising and tenoning; and, if firmly put in it will be quite strong enough for all the strain it will ever receive. Glue this frame together, and start to the next, which is shown in Fig. 10. This frame when in position rests one end on the floor, and the other forms the top rail of the chair. Two rails, 3 feet 11 inches long by $1\frac{1}{4}$ inch by 1 inch are required—one, 1 foot $7\frac{1}{4}$ inches by 2 inches by 1 inch, and another the same length 1 inch square. These last two are to be mortised into the first two on their $1\frac{1}{4}$ inch faces as before, and the size

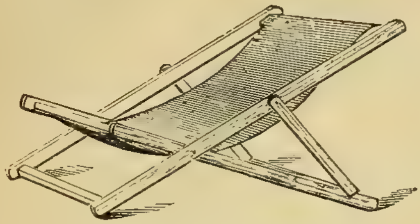


FIG. 1.—CHAIR IN LOWEST POSITION.

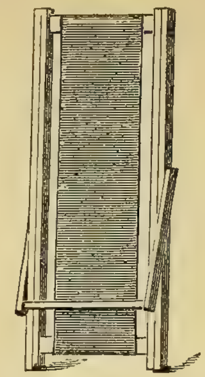


FIG. 4.—CHAIR WHEN FOLDED AND FLAT AGAINST WALL.

FIG. 2.—CHAIR IN MOST UPRIGHT POSITION.

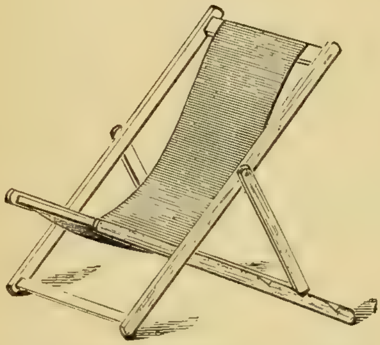


FIG. 3.—CHAIR IN MIDWAY POSITION BETWEEN THOSE SHOWN IN FIGS. 1 AND 2.

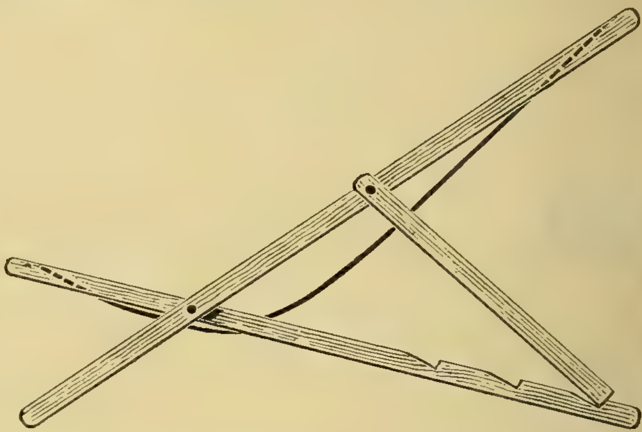


FIG. 5.—SIDE ELEVATION OF CHAIR IN POSITION SHOWN IN FIG. 1.

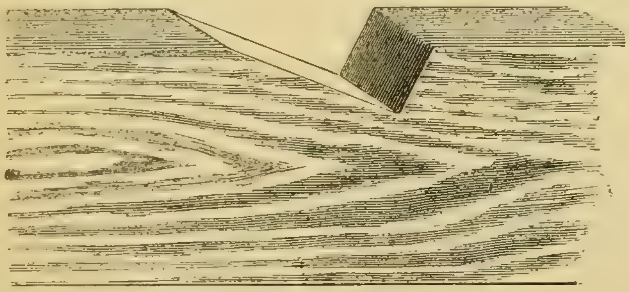


FIG. 14.—DIAGRAM SHOWING HOW TO CUT NOTCHES IN RAILS—FULL SIZE.

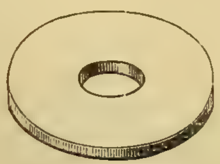


FIG. 15.—WASHER ON PIVOT BETWEEN PARTS OF FRAMING.

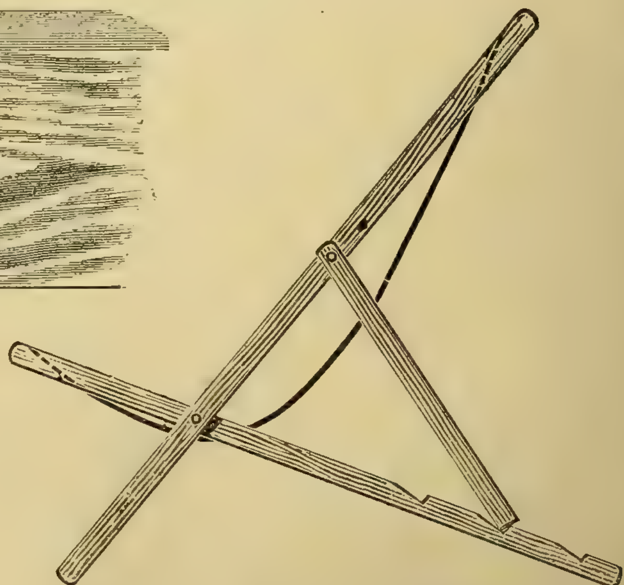


FIG. 8.—SIDE ELEVATION OF CHAIR, AS SHOWN IN FIG. 3.

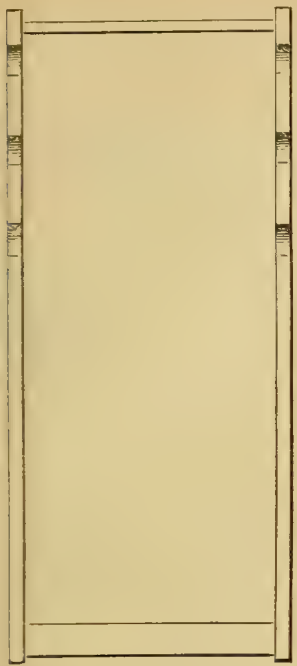


FIG. 9.—FRAME FORMING SEAT OF CHAIR.

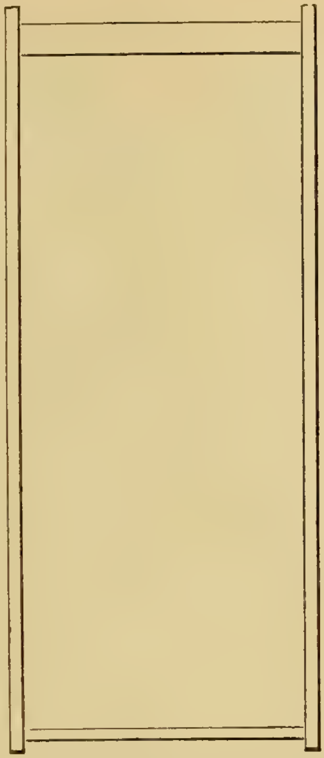


FIG. 10.—FRAME FORMING BACK OF CHAIR.

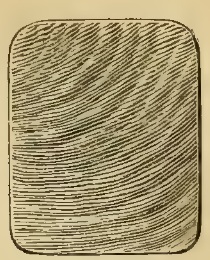


FIG. 13.—SECTION OF RAIL.

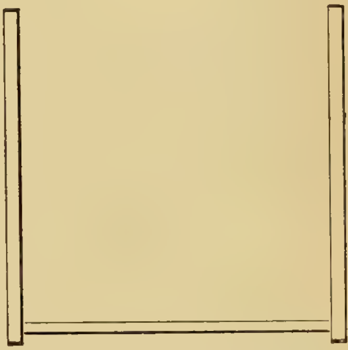


FIG. 11.—FRAME SUPPORTING BACK.

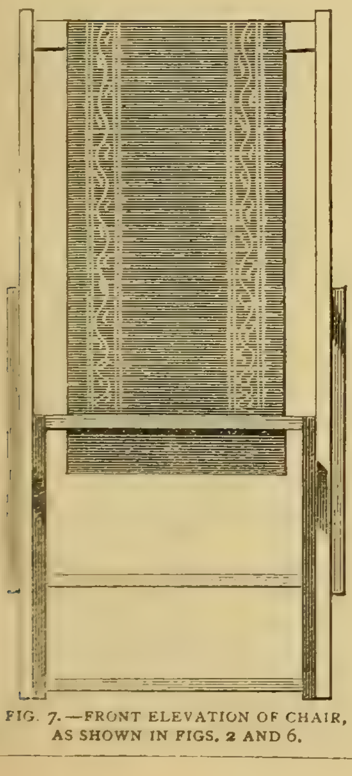


FIG. 7.—FRONT ELEVATION OF CHAIR, AS SHOWN IN FIGS. 2 AND 6.

Figs. 5, 6, 7, 8, 9, 10, and 11 are on Scale of 1 inch to 1 foot. Figs. 12, 13, 14, and 15 are full size.

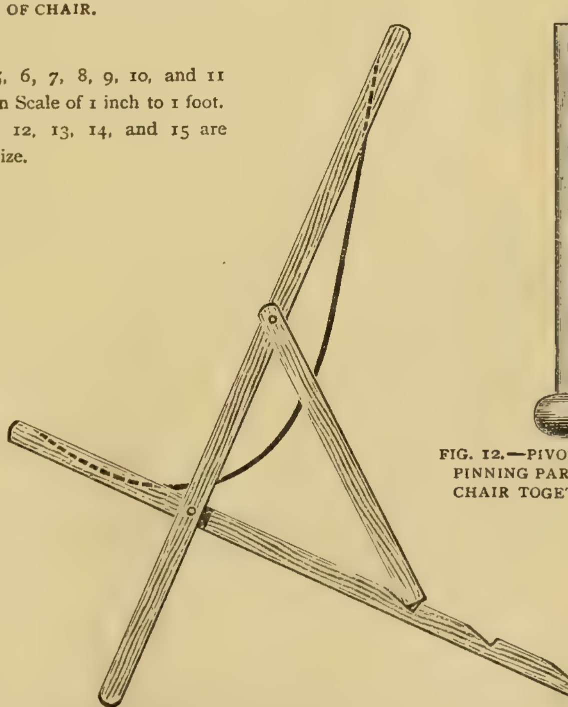


FIG. 6.—END ELEVATION OF CHAIR, AS SHOWN IN FIG. 2.

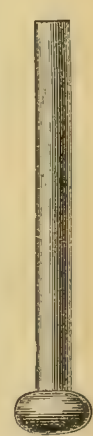


FIG. 12.—PIVOT FOR PINNING PARTS OF CHAIR TOGETHER.

from shoulder to shoulder will be 1 ft. $5\frac{3}{4}$ in. The square one of these two short rails should be made either octagonal or round. The remaining portion of the chair is shown in Fig. 11 ; two pieces are required, 1 foot 9 inches long by $1\frac{1}{4}$ inch by 1 inch, and one rail 1 foot $9\frac{1}{2}$ inches long by 1 inch by 1 inch ; this latter is to be mortised into the other two on their $1\frac{1}{4}$ inch faces and close to one of their ends, and the size from shoulder to shoulder is 1 foot 8 inches. It must be left square—neither octagonal nor round—for it is intended to rest in the notches already cut in the frame first made.

The chair has now to be put together, and, as already mentioned four iron pivots are wanted. These may be strong pins with a head on them, and of soft enough metal to spread out when hammered like a rivet. Small bolts are sometimes used for this purpose, in which case the heads may be sunk into the woodwork, and the nuts, of course, must be projecting—which projection is anything but desirable. This, however, will not interfere with the folding of the chair if care is taken to keep the nuts always on the *outsides* of the frames. But I think the pin already described is, on the whole, preferable.

Now, in the first frame (Fig. 9) bore a hole sufficiently large for the pivot to enter quite freely in each of the long rails. Place this hole about 1 foot from the end which contains the broad rail, and watch that it goes through the $1\frac{1}{4}$ inch face of the wood. Then take the second frame (Fig. 10) and cut holes for the same pivot to go through about 1 foot 3 inches from the end with the narrow rail. Farther along in this same frame, about 1 foot 2 inches from the holes already made, bore other holes for the second pair of pivots, and in the open ends of the piece shown in Fig. 11, bore holes, also for the second pair of pivots. Take the first frame (Fig. 9) again into your hands, and put the second one (Fig. 10) outside it, so that the first four holes bored come all in a line with one another, put a pivot into each side with a washer between each frame. This washer may be of leather, metal or wood, no matter which, but should be less than one-eighth of an inch in thickness, and about one inch in diameter, with a hole large enough to let the pivot through easily—see Fig. 15, which is a sketch of the washer ready for using. Take the third part of the chair now, and get the remaining four holes in a line with each other ; slip a pivot in each side, having a washer between each piece of wood as before. The chair will now stand in its various positions; but before fastening in the pins, it will be as well to give it all the varnishing or polishing it is to get. For this purpose take it all asunder again. A couple of coats of spirit varnish would do quite well, or it might be stained brown and then varnished. To do this, get from a drysalter's an ounce of vandyke brown in powder—it will cost only a mere trifle—mix it with water until moderately thin, and apply with a brush. A little thin, thin glue mixed among the colour would help it to stick. The principal thing to be careful about is to get the stain spread equally all over—not darker at one place than at another ; and to attain this, no portion should be gone over twice; and let no time be lost in doing each piece, for the wood absorbs the colours so quickly that at every fresh dip of the brush, there is a danger of an overlapping of the stain of the previous brushful, thereby occasioning a dark mark. Of course, any colour might be used in place of the brown—for instance, yellow, maroon or black, to represent different woods. A coat of varnish over the stain of whatever colour it may be that has been used, will be sufficient to protect it, and will also give a finished look to the job.

When all has been so far successfully performed, the chair must be put together as before, and the ends of the pins forming the pivots hammered down a bit, spreading the metal out as well as possible ; but do not hammer so much as to make the frames so tight that they won't move freely.

The upholstering has now to receive attention ; but all there is, is so exceedingly simple, that a child might be able to execute it perfectly. The material to be used might be a piece of carpet, or some sufficiently strong cloth to bear the weight of a moderately heavy individual with perfect safety. I have already mentioned the size required and only need to state that it should be nailed to the under side of the front rail of the seat and on the under edge of the top rail—carrying it, of course, over the top edge of the top rail and down the back to the under edge. It will be none the worse of having plenty of nails used—say, one every inch, and closer at each end.

I may mention that if the material chosen is quite plain, it will afford a nice opportunity for other members of the family to lend a helping hand. Dainty hands and deft fingers can work wonders in needlework; and, no doubt, their owners will be proud to have such a chance of displaying their skill in this direction.

Our chair finished, the best thing we can do is to sit down in it and enjoy the fruit of all our labour, declaring it to be the most comfortable chair in the house for a tired and weary individual. As regards the *otium cum dignitate* of the matter, which I may freely render as "dignified ease," I think I am justified in asserting that no ease is so intimately associated with that phase of dignity which may be described as self-respect, as the ease which has been won conjointly by the exercise of brain power and the work of a man's own hands.

BEE-HIVES AND BEE-FURNITURE.

By WALTER J. STANFORD.

V.—Cylinder Extractor—Honey Tin with Straining Rim—Gerster's Wax Extractor—Bingham's Uncapping Knife—Skep Knife—Scraper—Raynor Queen Cage—Pipe Covered Queen Cage—Spray Diffuser—Carlin Cutter—Driving Irons—Queen Excluder.

WE next come to a cylinder extractor. They cost to buy about 30s. to 40s., and if you know how, you can make one for about 15s., every bit as good. The tin for this, as well as for the Little Wonder, should be strong, and of the very best quality. First make a plain cylinder, 2 feet long and 15⅝ inches in diameter, and bind one edge with strong iron wire all round. Cut a bottom for it, large enough to allow its being soldered inside the cylinder, not at right angles, but sloping so as to make all liquid that may be inside run to one side, where a tap is to be fixed. If you cut a plain circle of tin 16 inches in diameter it will allow for this slope, and for the edges being turned up at right angles and soldered to the sides of the cylinder. Before this bottom is fixed in, however, the *exact* centre must be found, and a ½ inch diameter, and ¼ inch deep, brass cup soldered there. The under side of this cup must be filed off to allow for the slope of the bottom, *i.e.*, when the cylinder is upright its bottom should slope, but the surface of the cup should stand horizontal. Solder in the bottom, and then cut a strong rim 3¾ inches deep to fit round outside the bottom of the cylinder, binding both its edges with iron wire.

A semicircle must be cut out of this large enough to admit the foot. This is then soldered to the outside of the cylinder without any special joint, but there should be, at least, 1 inch of surface overlapped by the two, to give the solder a firm grip. The semicircular hole should appear at the back, or high end of the bottom, and is wanted to assist in keeping the extractor steady while in use. Next solder 1½ inch treacle tap into the cylinder in front, as near the bottom as possible. This is held securely by cutting the hole for it ½ inch less in diameter than the diameter of the tap, and then turning up the edge of the hole at right angles outwards and soldering the tap to this rim. The end of the tap will probably have to project a little into the cylinder. Cast two ¼ inch brass winged nuts, and forge two bolts to fit them, putting screw threads on each, and rivet the bolts to the outside of the top edge of the cylinder in the centre, as shown Fig. 58. A pair of fish-kettle handles riveted on about 7 inches from the top completes the cylinder.

To make the cages for it, Fig. 59, cut four pieces of tin 17 inches by 3½ inches, turn back, and hammer down a piece of each long edge, and turn up both long and one short edge of each ½ inch at right angles so as to form a kind of trough 1⅞ inch wide inside, and ½ in. deep, closed at one end and open at the other. Cut two pieces of tin 9 inches by 3½ inches, and bind their long edges with iron wire; cut two more pieces 9 inches by 2¼ inches, turn back and hammer down their long edges. Next take two of the trough shaped pieces and one of each of the others, and fasten the four together, frame-shaped, by riveting on the 9 inches by 3½ inches in pieces between the two trough shaped pieces 1¾ inch away from the open ends of the troughs, and the narrow piece inside the closed ends of the trough, riveting to the turned up end itself. The 9 inches by 3½ inches piece I shall call "the *inside* cross-bar," in explaining the rest. Cut two more pieces of tin 9 inches by 1½ inch, and solder one of these *outside*, level with the open ends of the troughs, and the other also outside about 2 inches from the closed ends. Make a second frame exactly similar to this. Cut a ½ inch iron rod 2 feet long, and wrap it round with tin to within about ½ inch of each end. Get two 1 inch by ½ inch pieces of wrought iron, heat them and punch a ½ inch hole in the centre of each to fit the rod, and also a slot for a key. Leave about 2 inches square in the centre of each the original thickness, and hammer down the rest on either side to about ⅛ inch thick, leaving the whole 9⅞ inches long. Rivet one of these to the two bottom cross-bars of the frames in the centre, so as to leave the cages 9⅝ inches apart or a little less. Turn up about 2½ inches of the other piece at right angles, and rivet it exactly in the centre to the "inside cross-bars." The details of this are shown clearly, Fig. 59, where the two outside cross-bars have not been drawn on the near cage to show the rest more distinctly. Next make two tin frames as Fig. 60, which hang inside the cages on the two outside cross-bars at the top of each. These frames should exactly fit the cages inside; 17 inches by 8¾ inches outside dimensions, ¾ inch wide all round, and bound on the outside with iron wire. Strengthen these by soldering three pieces of iron wire across one of the faces of each, about equal distances apart, and on the other sides stretch and solder pieces of small wire netting, soldering to the cross-bars where they touch as well. Two iron wire hooks added to each complete them. Cut two pieces of deal 7 inches long and 1¼ inch thick, and screw them from underneath to the centre of the bottom cross-bars. The sides of the frames of honey rest on these, and the extra length of the top bar gets room below. A pair of inverted cog-wheels are next required, but I cannot advise as to where they can be bought ready

made. Mine were discarded in a water-power mill during improvements, and almost every place where machinery is used, has a discarded pair, no further use for their work, but quite good enough for this purpose; but if any amateur knows where such wheels can be bought for certain, he would confer a boon on his fellow-labourers by furnishing the information. Mine are in the ratio of six to one, which gives great speed with very little work. Fig. 62 shows the inside of my large inverted wheel, and Fig. 63 the outside and handles. The pair to Fig. 62 is shown in place both in Figs. 58 and 59. A bar of $\frac{1}{4}$ inch iron, 18 inches by $1\frac{1}{2}$ inch, is cut to fit on to the two bolts at either side of the cylinder. Punch a hole in the centre of this, large enough for the tin-covered rod to pass through, and turn easily in. Now take the tinned rod; round off one end, and fix the small cog-wheel with a key to the other, pass the rod through its hole in the bar, put the bar on the bolts, and screw down the winged nuts. If the length of the rod is correct, the cog-wheel should be turning almost on the surface of the bar, and the rounded end in the cup. If not fitting well, it can be filed or cut if necessary, and for this reason, it is well to make it a little long at first. Turn a piece of iron, as shown in section, Fig. 63, and make a nut to fit it, and fasten it to the bar for the inverted wheel to turn on, with the two sets of cogs working properly. Next key the cages to the rod, allowing a clear 17 inches from the bottom of the cages to the under side of the little cog-wheel. A pair of covers like Fig. 61 complete the cylinder extractor.

The next appliance we come to is a honey tin with a straining rim, which is a most useful and necessary article both for straining honey after extracting and for comfort in bottling. Fig. 64 shows the honey tin and its cover, and Fig. 65 the straining rim. It can, of course, be made any size, but the size given here (that of my own tin) is quite large enough for a small apiary. Make an ordinary tin cylinder $8\frac{1}{2}$ inches in diameter and $9\frac{1}{4}$ inches deep, bind the top edge with iron wire, solder on a bottom in the ordinary manner, and $1\frac{1}{4}$ inch bottom rim with an iron wire bound edge. Rivet on a bucket handle, and as near the bottom as possible solder in $1\frac{1}{2}$ inch treacle tap, as before described. Next make Fig. 65. This is a plain hoop of tin with one edge turned back and hammered down, and $\frac{1}{4}$ inch of its other edge turned outwards at right angles. It should be made to fit exactly into the top of the tin. Put this in its plac e and make a lid for the whole. When honey is to b strained stretch a piece of fine canvas over the mouth of the tin, let it drop slightly bag-shaped into the tin and grip it firmly with the straining rim.

We next come to Gerster's Wax Extractor, and although there are many much simpler contrivances for the purpose, there is none so clean and perfectly satisfactory as this pattern, which is an improvement on the original Gerster. Its principle consists in the wax being extracted entirely by steam. First construct Fig. 66, which is a plain cylinder of tin 10 inches in diameter and $4\frac{1}{2}$ inches deep, bind its top with iron wire, and fix on a bottom with soft solder. Cut a $\frac{1}{2}$ inch hole near the bottom, and solder on outside the tin sort of spout shown in Fig. 66. This is useful in seeing how much water is in the boiler when in use, without lifting off the rest. Rivet on a pair of handles, and turn to Fig. 67. This is made out of perforated tin one hundred holes to the square inch. Make a plain cylinder of this $9\frac{1}{4}$ inches in diameter and $6\frac{3}{4}$ inches deep, and bind one edge with iron wire. The bottom for this is also of perforated tin, but is not flat in the usual manner, but slightly cone shaped, the vertex of the comb inside the cylinder and about 2 inches high. This is fastened to the cylinder in the usual way by turning over the inside edge and soldering, but before fixing it in its place, cut a 2 inch hole in the centre round the vertex of the cone. Construct a small cylinder of the perforated tin 2 inches in diameter and 6 inches long. Solder a plain tin top to one end, and solder the other end into the 2 inch hole. Three feet, each $1\frac{1}{2}$ in. long, of tin or iron wire soldered to the outside complete the strainer.

Fig. 68 is the next part (it is almost better to make this before Fig. 67, but if you keep to dimensions it doesn't matter much). Make a tin cylinder 10 inches in diameter and 9 inches deep, bind the top with iron wire, cut a similar cone-shaped bottom for it, and solder $1\frac{3}{4}$ inch tin cylinder open at both ends, and $6\frac{7}{8}$ inches long in the centre. Make a tin rim 1 inch deep, and of outside dimensions equal to the inside diameter of the boiler. Turn back and hammer down one edge of this, and turn up the other edge at right angles. Now join the cylinder, its bottom and this rim together, by turning up the lower edge of the cylinder, and that of the bottom outwards at right angles. Solder the two turned up edges of the rim and the bottom together, and then solder them to the cylinder lapping over both of them its turned up edge. A splendid joint will thus be made. Rivet on a pair of handles, and a $\frac{5}{8}$ inch tin spout from 3 inches to 6 inches long. A tap or cock fitted to this spout would be a most valuable addition. Make a lid for the whole, Fig. 68. To use it crush up the broken comb in any old bucket, transfer this to the inside of the strainer, put the strainer thus filled into the outer cylinder, fill the boiler and put the whole on the range. Get any tin basin, put a little hot water into it and stand it under the spout. As soon as the water boils steam will be generated, and pass up the $1\frac{3}{4}$ inch plain in pipe, hit against the top of the perforated tin pipe

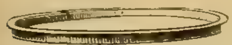


FIG 65

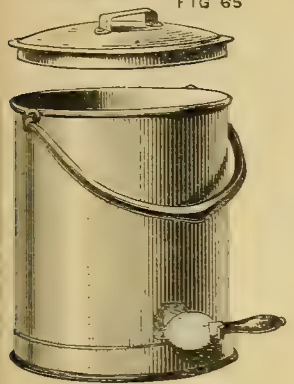


FIG 64

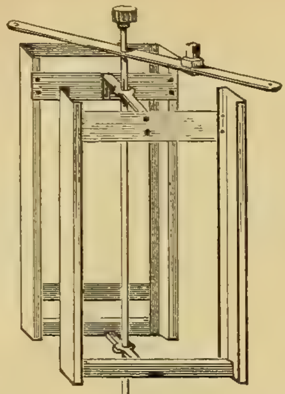


FIG 59

FIG 72

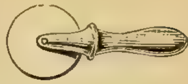


FIG 76

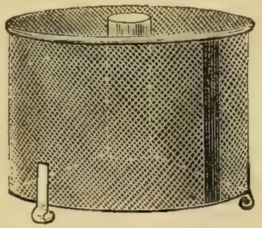


FIG 67

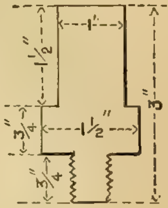


FIG 63

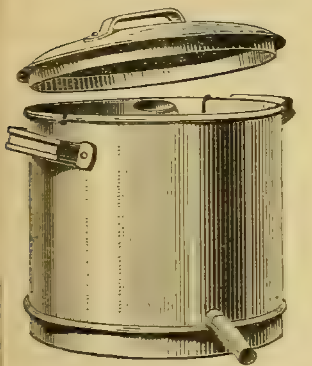


FIG 68

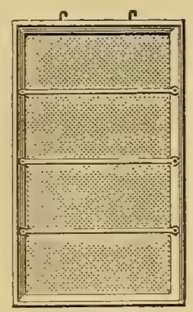


FIG 60

FIG 71

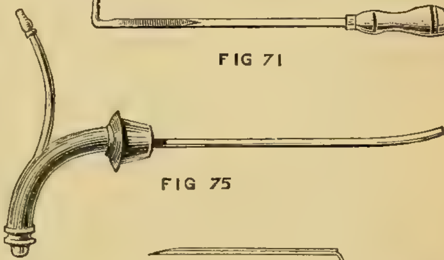


FIG 75

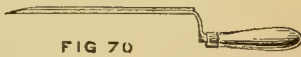


FIG 70

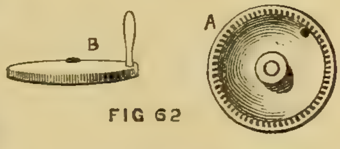


FIG 62

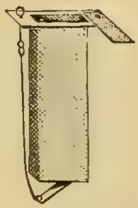


FIG 73

FIG 61

FIG 66

FIG 69

FIG 77

FIG 74

FIG 79

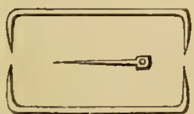


FIG 78

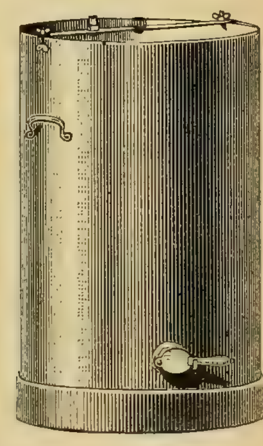


FIG 58

FIG. 58.—CYLINDER HONEY EXTRACTOR. FIG. 59.—CAGES FOR DITTO. FIG. 60.—FRAMED WIRE NETTING FOR CAGES. FIG. 61.—ONE OF THE COVERS FOR EXTRACTOR. FIG. 62.—INVERTED COG-WHEEL, INSIDE (A), OUTSIDE (B). FIG. 63.—SECTION OF RIVET FOR INVERTED WHEEL. FIG. 64.—HONEY TIN AND COVER. FIG. 65.—STRAINING RIM FOR DITTO. FIG. 66.—BOILER FOR WAX EXTRACTOR. FIG. 67.—STRAINER FOR DITTO. FIG. 68.—TIN FOR HOLDING STRAINER AND COVER. FIG. 69.—UNCAPPING KNIFE, BACK VIEW. FIG. 70.—DITTO, FRONT VIEW. FIG. 71.—SKEP KNIFE. FIG. 72.—SPATULA FOR CLEANING FLOOR BOARDS. FIG. 73.—RAYNOR'S QUEEN CAGE. FIG. 74.—PIPE COVERED DITTO. FIG. 75.—SPRAY DIFFUSER. FIG. 76.—COMB FOUNDATION CUTTER. FIG. 77.—WINTER PASSAGE CUTTER. FIG. 78.—SET OF DRIVING IRONS. FIG. 79.—QUEEN EXCLUDER FOR BROOD NESTS.

be turned back and diffused through the broken comb. This will melt the wax, which together with condensed-into-water steam, will run out into the basin. Two to three hours will separate all the wax. Borrow several china or tin shapes from the cook, dip them in cold water, and pour the contents of the basin into them. Leave them to cool slowly, undisturbed, and when cold take off the cakes of wax floating on each, it will be very pure and of a beautiful colour. To clean the whole apparatus dip the dirty parts in a tub of boiling water and washing soda and dry them well.

Figs. 69 and 70 show the back and front respectively of a Bingham Uncapping Knife for cutting the sealing off the comb before extracting. Cut a piece of steel 7 inches long and $2\frac{3}{4}$ inches wide, sharpen it all round on one side, as shown, Fig. 69, to give a chisel edge, and weld on a piece of iron standing up about 1 inch at right angles with a spike to take a wooden handle.

Fig. 71.—A Skep Knife is useful for cutting out combs from the tops of skeps, and consists of a steel blade 2 inches long and $\frac{5}{8}$ inch wide sharpened like the uncapping knife, with a handle about 14 inches long.

Fig. 72 is a useful appliance for scraping and cleansing floor boards of hives, and is simply a piece of steel 3 inches wide at the widest end, narrowing off to about $\frac{3}{4}$ inch with a handle attached, and sharpened like a furniture scraper, as described in AMATEUR WORK, Vol. IV., page 52.

To make the Raynor Queen Cage, Fig. 73, cut a piece of perforated tin $5\frac{1}{2}$ inches by 4 inches, fold and solder it to make an oblong cage $1\frac{1}{4}$ inch by $\frac{1}{2}$ inch inside. Cut a piece of tin $2\frac{1}{2}$ inches by $1\frac{3}{4}$ inch, and cut a hole in the centre of this $1\frac{1}{4}$ inch by $\frac{1}{2}$ inch. Solder this to the perforated cage; to make a flange all round one of the open ends, and rivet a piece of perforated tin to one side of it as a revolving lid for the cage. Hinge a piece of tin to the bottom, as shown, Fig. 73, and make a connecting rod of light wire between this hinged bottom and one of the flanges at the top.

Fig. 74 is another kind of Queen Cage commonly called "A Pipe Covered Queen Cage," and is simply a small tin cylinder 2 inches in diameter and 1 inch deep, with a piece of perforated tin soldered on to one end as a tap. The queen to be introduced is put into this, and its open end is pushed into one of the combs to the middle rib. Introduction, however, by cages is being gradually superseded, but as cages are useful, sometimes, I have described two of the best kinds here.

Fig. 75 shows a Spray Diffuser, useful when sprinkling two stock of bees with scented syrup, prior to uniting them; but as it would be almost impossible or an amateur to make a good one, and they can be bought for 1s. 6d., I don't intend to describe the making of one here. If you ask for an Aphicide at any seedsman's you will get the right article.

Fig. 76 is used for cutting comb foundation. It s commonly called "The Carlin Cutter," and is simply a plain circle of tin about 3 inches in diameter with a handle, and mounted to work as a wheel.

Fig. 77 is a very necessary appliance for cutting winter passages in the combs, is 3 inches long and 1 inch in diameter, made of tin, with one end serrated like saw-teeth.

Fig. 78 shows a set of Driving Irons. Their use will be seen by examining the arrangement by which the two skeps are held together, in the frontispiece of Cowan's book. Two pieces of bar iron, 12 inches long and $\frac{3}{4}$ inch square, are pointed at both ends and turned up $1\frac{1}{2}$ inch at right angles. A piece of $\frac{1}{2}$ inch bar iron shaped at one end, as shown in the short piece, Fig. 78, and the other end hammered down to a point, makes up the set as sold, but a common kitchen skewer answers quite as well for this last piece, and two pieces of wood with two nails driven into each end of both can be substituted for the iron rail.

Fig. 79 is a piece of Queen Excluder zinc for using in a brood nest if you want to keep the queen out of part of it. The zinc is made and sold specially for the purpose, and is large enough to allow the workers to pass through, but not the queen. It should be cut a little less than the inside dimensions of a brood nest, and then bound all round with tin, soldered on, to give it rigidity. I have now described all, and more than all, the necessary impedimenta for an Amateur Apiary, and hope to conclude in my next with drawings for descriptions of a Manipulating House—a very useful addition to an apiary, and a circular saw and bench, adapted to Hive construction.

(*To be continued.*)

PRACTICAL SCENE-PAINTING FOR AMATEURS.

By HENRY L. BENWELL.

XXIII.—EXTERIOR SIDEWINGS.

IT has already been explained in the chapter devoted to technical terms as to the use of sidewings on the stage of a theatre, and it now remains to give a few specimens and explanations of those exterior wings which are mostly in demand on the stage at the present time. The width of the wing will of course depend on the size of the stage and the space at disposal at the sides, but in any case,

they should never be less than two feet six inches wide. The regular width is about three feet six inches, and in large theatres more still. For the small amateur stage, wings may be made in the same way as drops, by fastening them at top and bottom to wooden rollers. But wings, being smaller and easier to handle, are much better made on wooden framework. In a drop wing, the edge of the canvas always has a tendency to curl; in fact, where foliage has to be painted on it and there is any cutting out to be done, the framed wing must be used. In preparing foliage wings, do not let the edges be straight, or they will look unnatural and too formal. To obviate this profile must be used (the manufacture of which will be described in another series), the edge of which is cut rugged with a keyhole saw by the carpenter, who works from the artist's pencil outline. As it is sometimes necessary, however, to paint some foliage on the back of a set of interior wings, with of course straight edges, the artist cannot do better than use the field wings mentioned hereafter.

The pair of tree wings (Fig. 124) are a fair sample of their kind, and it takes from three to four pair of these, even on the smallest stages, otherwise the sides of the stage will not be properly covered. The first pair of wings (Fig. 124), *i.e.*, those nearest the audience, should be painted clear and bold, whilst each succeeding pair, as they recede up the stage, should be fainter and more indistinct, the last pair matching the backcloth, which is always painted in with more delicate hues and tints than are those used on the wings in the first grooves. Hence an effect of atmosphere and distance is attained. In the painting of the foliage on the wings, the artist cannot do better than copy the individuality of Beverley or the "dotted" method of Birket Foster, the designs herewith taking more or less after either. The trunks of the trees in the first pair of wings should be bold and showy, and in the next pair less so; and whilst wings No. 1 have a good bit of burnt umber and black in the wooded portions, this should give way to rose-pink, white, etc., in the more distant ones. For further colours, the reader is referred to the "Table of Tints" to be given in the last chapter. Of course the design should be entirely different in each wing, and in cases where the scene represents a road, highway or footpath, it adds much to the picturesqueness of the whole thing if such objects as a milestone, a post or rustic rails, piece of an old stone wall, and other similar items, are introduced at the foot on the wings.

In some scenes where it is necessary to depict an open expanse of country with very little timber in the district, such as a moor or the Highlands, the tree wings would hardly prove suitable; a good substitute will therefore be found in the "field" wings (Fig. 125). These are from French's List of Amateur Scenes, and are here given because they can be had coloured and in an enlarged form from him at 89, *Strand*, *W.C.* The set of three pair are all different in design, so that the novice need be at no loss for variety of subject. The whole of the upper part in this design, which is left white both in these drawings and in French's sheet, should be coloured an azure blue to represent the sky; each pair following the front pair being painted gradually lighter in tone.

In such scenes as a rocky pass, the cliffs on the edge of the sea, or a Welsh glen, the heavy tree wings would again be out of place as a match to a backcloth depicting such a subject; so in order to have his stock of exterior wings as complete as possible, the theatrical manager should by all means have some four pair of wings of a similar character to the design Fig. 126. If the engraver does his work well, readers will admit these to be extremely pretty. They have been engraved direct from the coloured cardboard model, which can be had on loan for a small fee, for postage.

Other subjects sometimes used for rustic exterior wings are the ends of cottages, just showing a window or door, a garden porch, trellis work with clinging plants, and for garden views statuary.

In street scenes, it is necessary to have street wings, and these are of several descriptions, the principal being modern, ancient, and foreign. Again I have recourse to French's list, because here there is a set of six modern wings which are most suitable for amateur use, being simple in treatment as regards both drawing and colouring. Although it is essential to give these specimen designs, in order to complete as far as possible these papers on scenic art, I have really nothing of practical use to say about them, because the drawings speak for themselves, so that it would be absolute waste of space to offer any further and unnecessary remarks.

Not so, however, with regard to the variety of subjects, which, in fact, may be spoken of as being practically infinite. In everything connected with the mounting of a play, and especially as regards scenery and costume, it is necessary to impart as much "local colour" as possible—that is to say, to make the scenery depicted correspond closely with the landscapes, buildings, architecture, trees, and vegetable and floral products that meet the eye in that part of the world in which the scene is laid. In this respect it is impossible to take too much care or bestow too much research, and if the amateur scene-painter has no designs in his possession that are fairly suited to the subject he is about to treat, he may fall back with safety on the inexhaustible store of

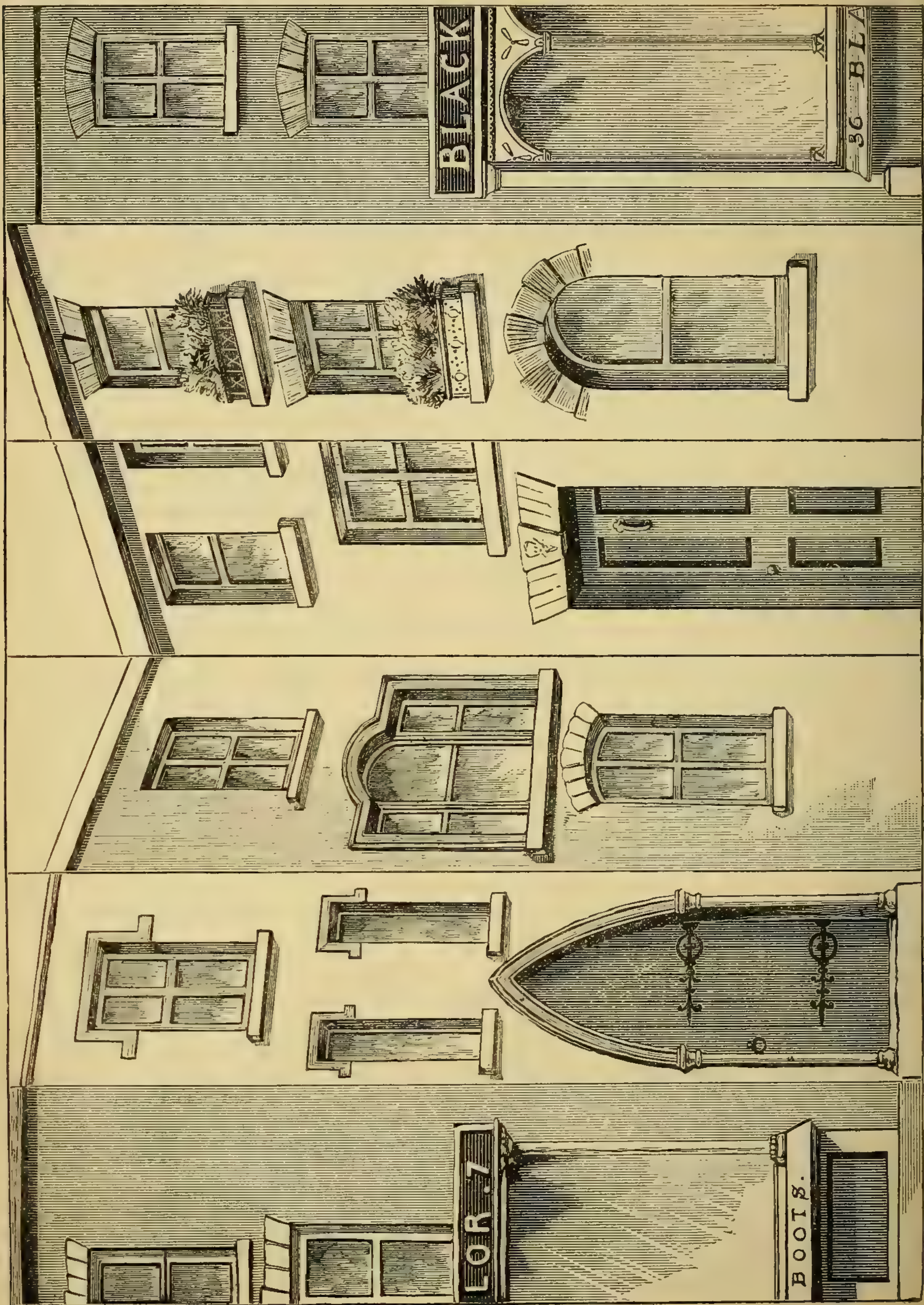


FIG. 127.—STREET WINGS. COPIED BY PERMISSION FROM FRENCH'S "AMATEUR SCENES."

illustrations furnished by back volumes of the *Illustrated News* and *Graphic*, and the many beautiful volumes in which local scenery is treated in the best possible manner, such, for example, as Roberts's "Views of the Holy Land," "Picturesque Europe," "Picturesque America," and many others which space will not allow me to mention.

In the next chapter will be given some designs for ancient and foreign street wings and borders, and this will bring to a conclusion the treatment and painting of exterior pictures. In the next few chapters we shall run quickly through a few useful interior views, and wind up with a chapter on stage perspective and a Table of Tints. The chapters on the painting of interiors must however of necessity be brief, however important the subject, because there are readers who, not caring one bit for scene painting, are burning to see fresh features introduced into these pages. If there is anything of importance as regards the painting of exterior scenes which has been overlooked and not mentioned in these articles, we shall be glad to have the same notified to us at once, so that it may receive attention and consideration before it is too late to appear in its proper place.

(*To be continued.*)

RIGHT.] FIG. 125.—PAIR OF FIELD FOLIAGE WINGS. [LEFT.

RIGHT.] FIG. 124.—PAIR OF TREE WINGS. [LEFT.

RIGHT.] FIG. 126.—PAIR OF ROCK WINGS. [LEFT.

PURE REPOUSSE WORK,

AND HOW TO DO IT.

By LANCELOT L. HASLOPE, Author of "Repoussé Work for Amateurs."

I.—WHAT REPOUSSE WORK IS AND WHAT IT IS NOT.

AS there seems to be considerable misapprehension as to the real meaning of the term "Repoussé Work," it will be well to consider what it refers to before I describe the method of doing it, particularly as it has been confused with "Raised Work," that is, work raised or formed by the hammer alone out of thin sheets of metal. This is very interesting work, and well worthy of the amateur's attention, but it is not repoussé work; indeed, it bears no more relation to it than the weaving of the canvas does to the picture the artist paints upon it.

Neither engraving nor incised work should be confused with repoussé work, though to the unpractised eye they might be mistaken for it. In the process of engraving, the metal is cut out with a "graver," and in incised work the same thing is done with a sharp chisel and a hammer In repoussé work, the tools used are always blunt, and do not remove any of the metal, it is by the action of the tool either depressed or pushed on one side. I would guard my readers against using a graver on their work, though they may be tempted to do so when they have a difficult corner to clean out; but the effect is sure to be spoiled, and there is no necessity for it, as every kind of design can be worked with hammer and punches alone. Repoussé work simply means "ornamenting thin metal sheets with raised figures," consequently, the repoussé worker proper has nothing to do with the formation of the articles which he ornaments, or indeed, with the "finishing" or polishing them afterwards, but as amateurs generally like to do the whole of their work themselves, I propose, in the course of these articles, to give directions for "finishing" the work, and also to describe how to form a few simple articles to be worked afterwards *en repoussé*, and which will serve as suggestions for other work.

Though repoussé work is probably one of the oldest of the fine arts, it has, until the last few years, remained entirely in the hands of professionals, and its adaptation to the purposes of the amateur are due, I believe, to our American cousins. There is a false kind of repoussé work much in vogue in the present day, against which I would guard my readers: this is done by fastening down a sheet of metal, generally brass, on a bed of either lead or wood, and then beating *down* the metal round the design, which has previously been traced upon it. In the first place, this is not repoussé work at all, as the raising of the figures should be done entirely from the back. If the ground is beaten down, beginning at the edge of the plate, and working towards the design, the figures certainly do rise, but it is impossible to give them the proper shape and form that they ought to assume, and the result is consequently most inartistic and unsatisfactory. This method has also the disadvantage of being very noisy and troublesome, and it is very difficult, as the metal stretches, to keep it steady on the block. I remember seeing it mentioned some time since as a recommendation of this mode of working metal, that the tools required were so few and simple—a hammer and bradawl, or even a French nail, being all that were required. As I am strongly of opinion that what is "worth doing at all is worth doing well," I recommend my readers to relegate common hammers, bradawls, French nails, *et hoc genus omne*, to their proper purposes, and begin their study of repoussé work with the same tools and appliances that are used by professional artists, more particularly as they are so simple, and now so easily obtained. There is no merit whatever, though some persons seem to think there is, in working with imperfect tools when proper ones are procurable. Mr. T. Gawthorp, of 16, *Long Acre*, *London*, whose beautiful designs I shall have to comment upon in the course of these articles, supplies all tools and other materials required; and being a practical art metal worker, any of my readers who patronise him may feel sure that they will have the best article that can be procured, and the most suitable for its intended purpose.

Pure repoussé work, by which I mean work ornamented solely by a hammer and punches of various kinds, is one of the fine arts, and as such, of course, requires time and steady application before it can be brought to anything like perfection; but if my readers will only begin at the beginning, and make the ground good as they go, they will soon acquire sufficient skill to produce work which will give much pleasure to themselves and their friends. The bane of amateurs is over-haste, and a desire to turn out finished work before the elements have been properly mastered. This is a great barrier to ultimate success, and I should therefore advise that each process be thoroughly practised before the next be entered upon.

In a series of articles on repoussé work, it seems impossible to keep the name of that great master of the art, Cellini, out altogether; but the gulf between him and the beginner, or even the ordinary professional, is so vast, that there is not much use in dwelling on him and his works. He has published, it is true, a book on Metal Work, which professes to describe his method of working, but his descriptions are so vague, and the class of work so difficult, that it is practically useless, at all events, to the ama-

teur. One of his peculiarities is, that he often raised portions of his work until it became detached from the background, and stood in high relief. The effect of this, when done by his masterly hand, was doubtless wonderful; but I think it has led others, who naturally look to him as *the* one to be followed, to value high relief too much, and to disparage all work in low relief. The value of work depends not on the height to which it is raised, but to the perfection of the modelling and the several relations that the various parts bear to one another. If my readers will examine one of Wyon's medals, for example, they will readily understand what I mean, and they will find that, though no part of the work be raised higher than the thickness of a card, yet owing to the beauty and perfection of the modelling, every part is in due proportion, and the total effect is charming. Good bold relief suits many subjects; but, on the whole, I should recommend the amateur to raise his work moderately at first: he will require a large amount of practice before he can turn out good work in low relief, and it therefore should not be attempted until he has had a good deal of experience. A knowledge of drawing sufficient, at all events, to enable the worker to draw curves easily and correctly, is desirable, though, perhaps, not absolutely necessary. One thing, however, is certain, and that is, that the greater the artistic talent the repoussé worker possesses, the better will be the work that he produces.

All the professional chasers, I know, are good draughtsmen; and it is not at all uncommon to see a chaser working without any design before him, trusting entirely to his eye for producing the required effects. An amateur will, of course, require a carefully-drawn design to work from, which should be transferred to the metal by the process I shall presently describe.

Now that the art of repoussé work has become fashionable, there is no difficulty in obtaining suitable designs. Mr. Gawthorp has a great variety, and, having skilled artists in his employ, will always make special designs when they may be required. There are a large number of beautiful drawings published quarterly in the *Art Designer*, 4, *St. Ann's Square, Manchester*, very suitable for our purpose; many of them, though originally intended for china painting, come out exceedingly well on metal, particularly where the design is not required to be raised as for trays and waiters. The Japanese are always a safe people to follow; and my readers will find that most of their designs, particularly those of birds and animals, form excellent subjects for this work. The backs of playing-cards, or even wall-papers, particularly dados, will often give useful suggestions; indeed, the sources from which an artist may gather hints to be worked out afterwards are, in point of fact, practically endless.

Having selected our design, we naturally come to consider what we shall work upon. The articles generally used are either cast, stamped, or spun in the lathe. Cast work is quite unsuited for the amateur's use, though it is sometimes put into the hands of the chaser to touch up, and give it the appearance of hand work. Spun work being made out of rolled metal answers well; but as it is much more difficult to work than flat sheet metal, I should advise the amateur to stick to this for some time at least. The thickness of the metal varies occasionally, but as a rule I always use 10 M.G. Silver, on account of its extreme malleability, may be used thinner than any other metal except gold; and to save cost it is generally not so thick as the size I have stated. All common metals, and most alloys, may be decorated with repoussé work; but, of course, the tougher and the more malleable the metal is, the better and easier it is to operate upon. Gold, from its great cost, can only be used for small and delicate articles; but silver is largely employed for all sorts of purposes. It is an admirable metal to work upon, and can readily be made to assume any form required—indeed, I think that anyone once using silver will not, if he can help it, use any other metal. It is, however, a great mistake to begin upon it, or, indeed, to use it at all, until considerable proficiency has been acquired. Nothing looks worse in my estimation than bad or indifferent work on silver; all the inaccuracies and imperfections seem to be intensified, and work that would pass on inferior metal looks a complete failure on silver. Fine artistic work will give real value to whatever it is put upon; but on the other hand, the precious metals gain nothing, but on the contrary, lose by having indifferent work put upon them. Copper is a very suitable metal for our use: it is soft, ductile, and of a good colour; but, on the whole, for general use I should recommend a good yellow rolled brass. It is pleasant to work upon, cheap, easily obtained, and looks extremely well when finished. It is rolled of various widths, so that it may be selected of a size to suit any design, and all waste may thereby be avoided. Yellow brass being soft and fusible, will not stand hard soldering; so that if the work has to be brazed together after it is finished, or anything—say a handle—has to be fixed on to it, what is called "brazing metal" must be used. This contains more copper and will stand a much greater heat. Both brass and copper have the disadvantage of requiring to be lacquered to preserve the polish. Though this is theoretically easy, practically, it is one of the most difficult things I know of. There are many alloys of tin passing under the names of

Argentine silver, Britannia metal, etc., that may be used; and as articles are made of them in all shapes, these will serve to practise upon, especially what is termed hollow work, that is, cups, vases, teapots, etc. I have not, however, found it very pleasant to work with. Lead and its alloys are, I think, better let alone; the work looks so common when it is done, and they are too soft to be pleasant under the tools. I am well aware that there is some exquisite work in the South Kensington Museum on pewter, but one's only feeling is one of regret that such work should have been put on such material.

Iron was often used in the Middle Ages for repoussé work, and very beautiful work is still occasionally done upon it. The examples I have seen, however, appeared to me to partake rather of fine forgings than repoussé work proper—I have had no experience with it myself, and, therefore, shall not attempt to describe the method of working on it.

The professional repoussé worker invariably makes his own tools as he requires them, and as it often occurs that special tools are required for special purposes, each man's stock is constantly increasing, and ultimately amounts to a considerable number—my own stock numbers about fifteen dozen, but it has been many years accumulating, and most of the tools are very rarely taken in hand—one of the best chasers in England once told me that the bulk of his work was done with about a dozen tools—I should recommend a beginner to commence with about half that number, and add to them as the exigences of his work require it; I do not recommend *sets* of tools as they are generally unsatisfactory, it is much better at first to go to a practical man, and get him to select for you, and when you have acquired sufficient experience, make them for yourself.

My readers will, at the outset, meet with two difficulties: the first is occasioned by the fact that the work is practically done with the left hand, as this holds the punch, and this, unlike chipping chisels and similar tools, requires careful and delicate manipulation; the second, and the more serious one, is the difficulty of raising the metal from the back, on account of the different appearance it presents in this side to what it does on the other. The first difficulty can only be got over by practice, but the second may be obviated, partly, at all events, by taking an impression in yellow wax, or a cast in plaster of Paris, as the work progresses; this will enable the workman to see how he is advancing, and save the trouble of taking the plate off the pitch and laying it down again. If a plaster cast of the design can be obtained, it will be found of immense service, and I should recommend the beginner to endeavour to get one before he makes his first essay in beating up.

Having now described what Repoussé Work is, and what it is not, I shall, in my next chapter, endeavour to show exactly how the work is done.

(*To be continued.*)

MODEL ENGINE-MAKING.

By JOHN POCOCK.

X. — VERTICAL ENGINE — CASTINGS — BURNISHING BRASS GOODS—CONSTRUCTION OF ENGINE.

THE next engine to be described is one of the vertical type, with the same stroke and diameter of cylinder as the horizontal engine just finished.

The castings required for this engine consist of the following pieces:—Two A standards, two bearings, cylinders, the two cylinder-covers, piston, steam-chest, slide-valve, gland for steam-chest, and gland for top of cylinder, eccentric and eccentric-strap, support for guide-bars, cross-head, crank and fly-wheel. Some makers will also supply the connecting-rod as a casting. Of these castings, the cylinder, steam-chest, piston, glands, the connecting-rod, the slide-valve, the eccentric and eccentric-strap, and the fly-wheel, will be in all respects similar to the castings of those parts used for the horizontal engine; and as they are to be treated in the same manner up to the point of fitting the engine together, we shall leave them on one side for the present, and proceed to speak of the pieces which vary in this engine from the analogous parts in the horizontal type. These pieces are shown in Figs. 80 to 86, while the bed-plate is shown in Fig. 87, having the position of the feet of the standards and of the cylinder marked upon it.

It may be here remarked that this engine makes a very pretty model, and with very little extra trouble it may be brought out highly finished, all the parts being filed smooth and burnished, with the exception of the body of the cylinder, which may be coloured with bright green enamel paint.

While on this subject I may as well, for the benefit of those amateurs who do not already possess the information, give directions for the burnishing, which gives the highly-finished appearance to brass goods, as seen in the shops.

The burnisher consists of a polished piece of steel of a shape to suit the work upon which it is to be used—the end of an old flat file, rounded off at the edges and well polished with the finest emery paper, makes a good burnisher for general purposes.

To use the tool it is dipped into ale, and rubbed over the work until a fine polish is brought up upon this latter.

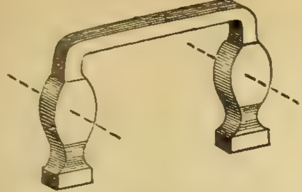


FIG. 82.—GUIDE BAR STAY.

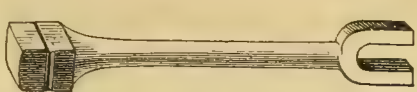


FIG. 86.—ECCENTRIC STRAP.

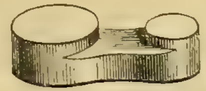


FIG. 84.—CRANK.

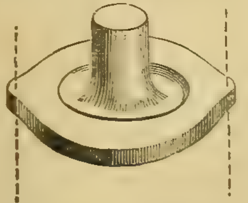


FIG. 85.—CYLINDER TOP.

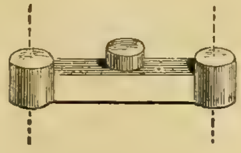


FIG. 83.—CROSSHEAD.

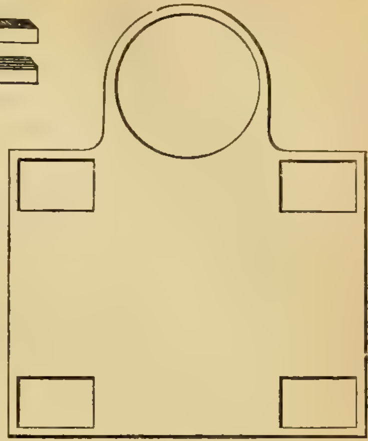


FIG. 87.—BED-PLATE.

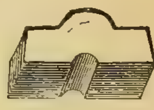
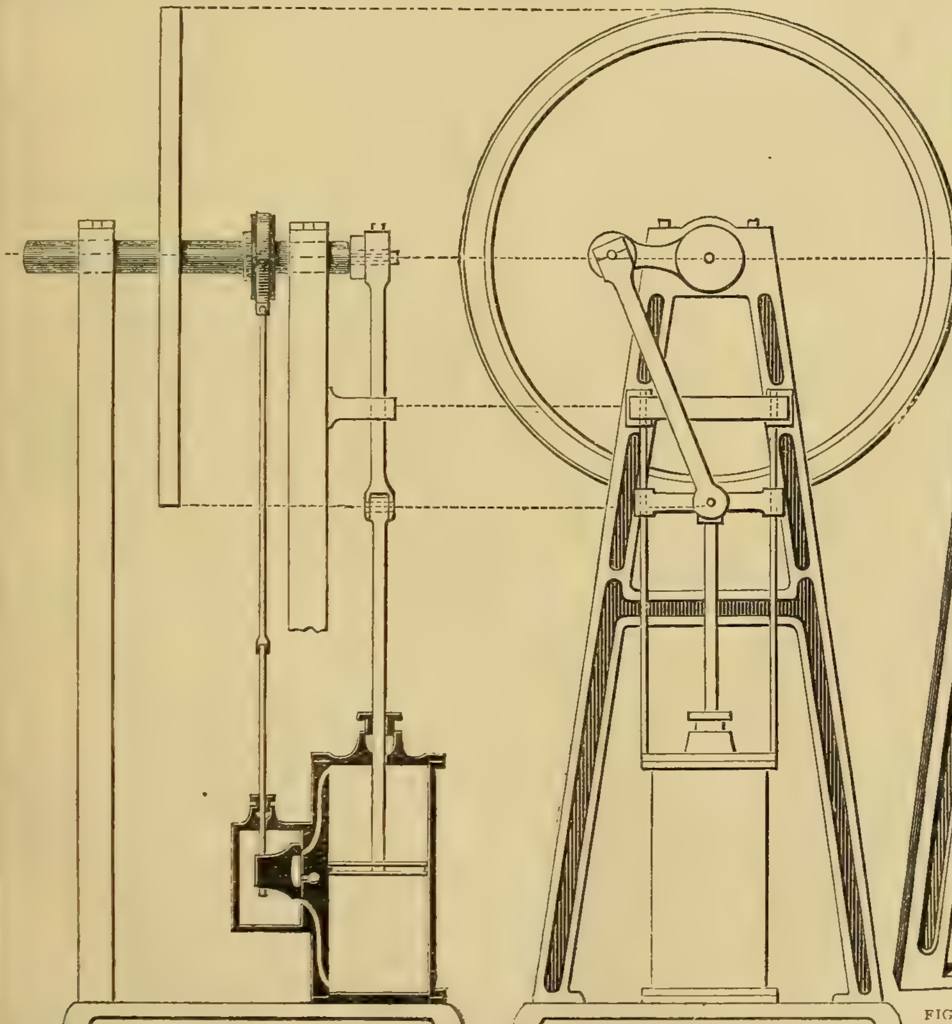


FIG. 80.—TOP OF BEARING.



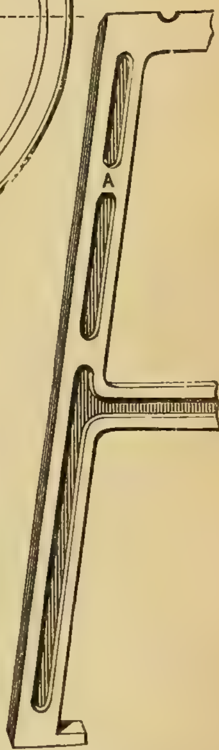


FIG. 83.—WORKING DRAWING—SIDE VIEW.

FIG. 89.—WORKING DRAWING—FRONT VIEW.

FIG. 81.—HALF OF STANDARD.

The surface of the bed-plate should be filed up flat and smooth; the position of the centre of the cylinder must be marked upon it; and when the circle for the screw-holes has been marked upon the cylinder bottom, a circle of the same radius should be struck upon the bed-plate from the centre marked, and two holes of a size to allow the screws to pass through them should be drilled diametrically opposite each other upon the circumference so struck. The cylinder-bottom must then be placed upon the bed-plate, and while it is held in place, mark upon it the position of these two holes just mentioned; the position of the other four holes for screwing on the cover being marked off as usual. When the bottom cover is screwed on to the cylinder, the two holes coinciding with those in the bed-plate are to be left without screws, to be used in finally attaching the cylinder to the bed-plate—rather longer screws, being of course, employed for this purpose, in order to allow for the thickness of the bed-plate. It will give a neater appearance to the engine when finished if screws with conical heads are used for screwing on the cylinder-bottom, the screw-holes being countersunk for the reception of the heads of the screws.

As will be seen from the drawing, the cylinder top has two lugs, or ears, which will prevent its edge being turned up in the lathe; therefore, when each surface has been turned up, and before the top is taken from the lathe, a circle should be marked with the graver of the same diameter as the outside of the cylinder flange, and the edge must afterwards be carefully filed away to this mark, save where the aforesaid lugs are left projecting. In marking the screw-holes upon the top flange of cylinder, it must be remembered that when the engine comes to be finally fitted up, a line drawn through the lugs on the cylinder top must be at right angles with the shaft of the engine.

The standards should be filed up smooth, and the tops left level; the ornamental grooves may either be scraped out bright or left as they are, or they may be painted over with enamel paint after the engine is finished.

The bearings may next be filed smooth, centre punched, and drilled for screws; the bearings must then be put in place upon the standards, and the position of the screw-holes marked on these latter, and drilled and tapped for $\frac{1}{8}$ inch screws. The bearings should then be screwed firmly to the standards and filed down to the same level at the sides and ends while *in situ*. If properly done, it should be necessary to look closely at the standards to see the joint between the two parts. A groove is left in the castings for the bearings and in the tops of the standards, so that when the two parts are screwed together the hole for the crank shaft will be formed between them. To bore this hole out to the right size a small D bit is the best tool. The finished diameter of the hole should be $\frac{1}{4}$ inch.

Before the bearings are taken off the standards they should be marked at the back, so that they may always be placed in their proper position without trouble. The feet of the standards may now be drilled for the bolts which are to hold them down upon the bed-plate.

The crank may be simply filed up smooth, or the bosses for the end of the crank-shaft and for the crank-pin may be finished off in the lathe.

The support for the guide-rods will be fixed at A A, Fig. 81. A hole must be drilled in each of the two legs of the front standard, and the guide-bar support being drilled and tapped in correspondence with these holes, the latter is screwed into place by screws passed through from the back of the standards.

The centres of the two bosses shown in Fig. 82 should now be found and punched. The exact distances between these centres must be taken with the compasses and marked off upon the cross-head, Fig. 83, and upon the cylinder top as shown by the dotted lines; these pieces are then to be drilled as marked, the cover to be tapped to take a piece of screwed steel rod about $\frac{1}{8}$ inch in diameter, the cross-head to be an easy fit upon the same rod so that it will slide up and down without shake, and the support with holes the least trifle smaller than those in the cross-head, so that they will be a stiff fit with the same rods. The holes in the support may be drilled right through or not, according to fancy—in the former case the guide-rods will of course be made rather longer, their tops being neatly rounded off. The cross-head must be drilled and tapped for the end of the piston-rod, and fitted to the connecting-rod, the joint being made by a steel pin passed through the connecting-rod and the cross-head, the other end of the connecting-rod being treated in the manner described in the case of the horizontal engine.

The shaft will be of the same diameter as that used for the horizontal engine; it will be made of a straight piece of round steel bar turned down to fit bearings, and $\frac{3}{8}$ of an inch at the cylinder and turned down to $\frac{1}{4}$ of an inch diameter and tapped, the larger boss on the crank being drilled and tapped to correspond. The smaller boss on the crank is to be drilled and tapped to take a $\frac{3}{16}$ inch screw, a steel pin one inch long being screwed into the same.

The engine may now be put together. Let the feet of the standards be filed down, if necessary, until the shaft bearings are perfectly level with one another, and the shaft runs easily. The position of the eccentric will of course be inside the front standard, and the cylinder, connecting-rod, fly-wheel, etc., being all

in place the position of the holes in the feet of the standards must be marked upon the bed-plate, and the cylinder being unscrewed, the bed-plate is to be drilled where marked, and the standards can then be bolted down, and the engine permanently fixed up.

Figs. 88 and 89 are working drawings half-size.

(*To be continued.*)

UPHOLSTERY AT HOME.

By DAVID ADAMSON.

III.—UPHOLSTERING "CHIPPENDALE" CHAIRS—HAY ROLL.

THOSE who have had the curiosity to compare the stuffing of an old chair, by which I mean one of the sort rather vaguely known as Chippendale, with that of a modern everyday kind of seat, will have noticed a marked difference in the arrangement of the materials and general structure of the upholstery.

In the old chairs there is a simplicity which is only equalled in the modern when pincushion stuffing has been employed, and on that account the upholstering of a "Chippendale" chair may well be the subject of the present paper. Very likely some of these may come under the hands of the amateur upholsterer, and if he have a taste for "chairs of structure antiquated," he will no doubt wish to try his skill in restoring them himself, as he may easily do, when he has been told how. In fact, with a little attention to the instructions which it is my privilege to give him, I think I may safely say that he will be satisfied with the result—perhaps more so than if he had given the work to an upholsterer who had no idea of fitness, one of the sort who would think it not unreasonable to put springs in the seat of a Chippendale chair. Well, my reader, who desires to become an amateur "Ragtacker" (slang or workshop term for an upholsterer), let us have a friendly chat while we go over your old chairs together, and endeavour to restuff them without any absolute anachronism.

What have you got? A couple of chairs that you picked up in an out-of-the-way place while on a cycling tour? Yes, and very good specimens too for our purpose, but if you think them Chippendale, I may as well tell you they are not. Certainly they are genuine old-fashioned things, but they were not made by Chippendale, nor are they his designs. Call them Chippendale chairs if you like, and you will, according to popular notions, not be very far wrong. Were we simply discussing the peculiarities of this maker's chairs, to which alone, strictly speaking, his name should be applied, we might talk for hours, and do nothing else. If all that are attributed to him came from his factory, or shop, as he would probably have called it, all the other cabinetmakers and upholsterers in the latter half of last century, and well on into the present, must have had a bad time of it, and have suffered considerably from slackness of trade. There could not have been much for them to do apparently, for every piece of furniture, provided it be made of mahogany, which has survived from that period, is regarded by some as Chippendale. Some of us, including you and I, know better, for what about Ince, Mayhew, Heppelwhite, Sheraton, and a host of others who supplied our forefathers with furniture. Chippendale's name, somehow or other, has come to the front, but it must, in the vast majority of cases, be considered merely as generic. To some minds it apparently signifies neither more nor less than "very old," many who use it having as vague ideas about furniture as the aged pilgrim who derived such comfort from the contemplation of that blessed word Mesopotamia had about spiritual matters. Am I wrong? I think not. I was once gravely assured by some one, he knew all about it, that he had some real Chippendale chairs; no doubt of them being genuine, as they were almost black with age, splendid mahogany, and at least *two or three hundred years old.* I never saw the chairs, which I am sorry for, as I should say, if my informant were correct, they were unique. They show that mahogany was used in this country as a furniture wood a century or so before it is generally supposed to have been, and they throw some interesting light on the mature age Chippendale had reached before he published his first book of designs in 1754, or just one hundred and thirty-three years ago. Poor old Chippendale must have been getting, to say the least of it, somewhat venerable when he died. Though, stay! is he dead? for it is only a year or two since I was shown a chair frame which had been sold to a connoisseur, who, singularly enough, knows just as much about old furniture as the fortunate possessor of the two or three hundred year old mahogany lot. The owner said it was a genuine bit, so as it was evidently quite new and fresh from "The Road," Chippendale must have been still at work very recently. Judging from this later specimen, his hand has lost its cunning, which is not surprising, as from the data given he must now be between 200 and 300 years old. I don't quite see how this can be, and, like yourself, I prefer to think that Chippendale published his designs while in the prime of life, and died in the ordinary course of nature. His name has been associated with a style which I, for one, would be far from saying he originated, perhaps chiefly because he was a Court cabinetmaker, and turned out principally carefully-finished, sound work.

Many of his designs, especially those based on the rococo, are florid in the extreme, while however much the delicacy and ingenuity of some of them may be admired, few if any can be regarded as models to be imitated at the present day. The specimen we have before us (Fig. 13) is free from his fantastic lines, a good plain honest chair, nothing more, carefully and soundly made, with a seat one does not fear to sit upon, and a back that is evidently intended as a support. Notwithstanding its almost severe simplicity, perhaps because of it, there is a charm about this old chair which grows on one. There is nothing offensive about it, nothing obtrusive, neither can its plainness be mistaken for ugliness. There it stands, firm and solid as when it left the bench of some dead and gone unknown maker whose work survives him, as our work, if it be equally true, will survive us, and show to coming generations that even at the present time the conscientious handicraftsman still existed, although certain artistic pessimists choose to assert the contrary. None so blind as those who won't see. Look about you, you who think that only old furniture was carefully made, and if you have eyes free from prejudice, acknowledge that no better woodwork was ever constructed than now. If you can't see that for yourself, instead of taking for truth all the rubbish that has been written by people who know nothing about furniture or its construction, go to some good maker, plenty of them are to be found, and get his opinion. He is much more likely to know the details of his trade than are the people who though possibly quite competent to give an opinion about what pleases *their* eyes can hardly be considered authorities on any other point connected with furniture. "I know what I like," is their text, and with effrontery only equalled by their ignorance, platitudes rendered into good English by the page are strung together to attempt to show that the old only is good, and all that is old is perfect.

No, I don't object to antiquarian research. Many a lesson may be learned from a study even of comparatively unimportant details, only don't let us be merely led to forget that it is with the present we must concern ourselves principally. It is well to observe the things of "unregarded age in corners thrown" when we meet with them; also, well, nay better, to remember to "act in the living present,"— "and departing, leave behind us footprints in the sands of time." Is our age so deficient in vitality that none of its furniture designers will in time be deemed worthy to be named as equals with Chippendale, Heppelwhite, Sheraton? What about our Bruce J. Talberts, our Benns, our Timms? Will they not hold rank as high as any who have gone before them? You never heard of these people, my æsthetic friend? Well, I don't know whether I am surprised at that or not. They, and such as they, are at present only known among those whose business in life brings them in contact with artistic *work*, which is a very different matter from flabby sentimental dilettanteism.

But while we have been holding this "free and friendly conference," we have got the covering, or more correctly, coverings, off the seat of this old chair, for it is evidently one which has sunk in the social scale since it was made, till it was rescued from still further degradation. Like many a one it has seen better days; and now, poor old thing, we have stripped off the rags which, as is often the case in similar chairs, have been put one over the other. Not that each was ragged when first put on: it simply saved trouble to put a new cover on without removing the previous one.

If we examine them they too may tell their tale of bygone fashions in covering materials, may be, of very plebeian kind; indeed, most likely so, for had the chair remained in good society, it would have been re-stuffed, or at any rate, the old covering would have been removed before a new one was put on. The bottom or original covering we see, is our detested old acquaintance, hair-seating—a material at one time much in favour. There is also a damask covering with a strange old-fashioned pattern on it, a chintz covering, and other odds and ends in variegated patchwork. By the way, you will observe this chair has a loose seat, the frame, which is stuffed, being dropped into the frame of the chair. After getting the coverings off we remove the stuffing, fine dusty stuff it is, too, hardly worth cleaning, although it is hair. If you think differently, send it to some upholsterer to be done, and when you get it back don't be surprised to find that it has decreased in bulk, as you see the hair is much broken and very short. In the cleaning, a quantity more will break up and become waste material, to be removed during the process. If you have not confidence in the upholsterer to whom you think of sending the hair to be done up, don't send it, for you will assuredly not have returned to you as much as you send him. Keep your hair, dirt and all, rather than do as a friend of mine did. What was that? Just this: He had a chair which had belonged to his great-great (I forget how many greats there were to this particular ancestor) grandmother. In course of time this chair, or rather its stuffing, as might be expected, was rather the worse for wear. My friend was one of those with an unreasonable antiquarian bee in his bonnet, and declared that no modern stuffing was so soft and easy as that of his many-times-great-grandmother's chair, but at last he reluctantly came to the conclusion that it wanted re-upholstering. This he determined to do

himself—not that he knew how. Anyway, he sent the hair to be done up, and soon afterwards he came to me to know what he could do to the upholsterer he had employed, for that wicked individual had actually not returned him the same weight of hair (and dirt, let me add, on my own acccunt) that he had sent in. Could he sue him? Could he do this, that, and the other? Wasn't it a fraud, a robbery, etc., etc.? I did not know the hair or the upholsterer in question either, but I explained the matter as it probably stood, and suggested that fresh hair should be added to make up the deficiency. I then found my friend valued very much all the parts of the chair that had belonged to his relative, and particularly wanted to use the old materials only, "neither more nor less," as the Rev. Mr. MacScroggie said, when after much pressing he consented to take two tablespoonfuls of whuskey. (MEM.—This quantity just fills a good-sized wine-glass, but it sounds better calculated by spoonfuls.) He was not particular about the covering, but the loss of the hair distressed him. It seemed to him a desecration — looked as though he had no regard for the old lady's memory, etc., and modern hair was not so good as that used one or two hundred years ago. He had examined some, searched for it everywhere, and could not find any fit to use. Very likely he could not, as the utmost price he was willing to pay was what?—6d. per lb. Quite enough, too, he thought. Had he been willing to pay from 1s. 3d. to 2s. per lb., he would have got as good stuffing hair as one need require. This is the kind of individual who is responsible for the "slop" work which is sold; unwilling to pay a fair price for a good material, though expecting to get the very best at any absurdly low figure which he, in his estimation, may think sufficient. Why on earth don't such as he go to people whom they can place some degree of confidence in for what they want, instead of purchasing from those whom they imply are endeavouring to defraud them. If they buy from respectable people, they will get value for their money. This is all they have a right to expect; but many of them seem to fancy they ought to get a good deal more, and that if they are only clever enough to persuade the seller that they know all about his trade, they will succeed. Somehow they never can convince a cabinet-maker or upholsterer that they know more than he does about his own work—not even the old mammas or mothers-in-

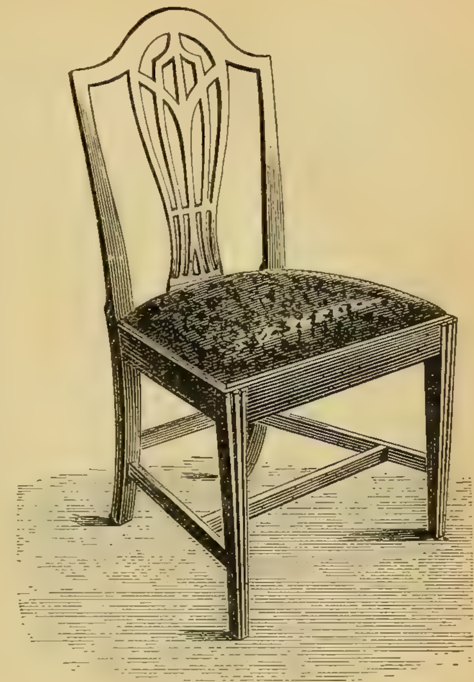
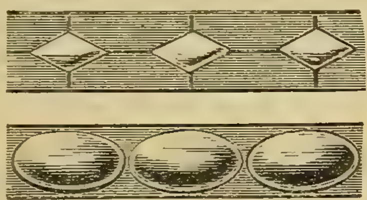


FIG. 13.—OLD CHAIR WITH HAY ROLL LOOSE SEAT.

FIG. 15.—FOUR ARRANGEMENTS FOR



BRASS STUDS ROUND OLD CHAIRS.

FIG. 14.—OLD CHAIR WITH HAY ROLL SEAT.

law-to-be, who, having superintended the furnishing of two daughters' houses, consider themselves as authorities on the cost of every article of household furniture when their third prospective son-in-law, in course of time, sets about fitting up his own house. The nice young man listens to the old lady's prosy, and what she no doubt considers useful advice, till he marries, by which time he, too, has probably come to the same conclusion that the upholsterer had at the first interview, viz., that she knows nothing at all about the worth of furniture. You would like to know whether I consider all tradesmen immaculate, and above suspicion in their dealings. No, of course I don't: they are neither better nor worse than other people; and if you know one who is a rogue, don't buy from him, leave him alone; but you are not justified in treating a man who may have something to sell as if he were not as honest as yourself, who, of course, would scorn to do anything mean or paltry. What about the "tricks of trade" you have heard of? Is there no dishonesty in trade? Yes, unfortunately, there is, and sometimes nearly as much on the seller's part as on the purchaser's, and that is saying a good deal. Oh! don't flare up, my reverend friend, even in your sacred calling the Old Adam often manifests itself in your dealings with the tradesman. The tricks of trade, regarded from a buyer's point of view, have often been commented on and exaggerated. Those seen from a seller's have not, though they are very apparent to him. He has them so constantly forced on his notice, and there is such a remarkable sameness about them that he can't help noticing and remembering them, however much he may try to persuade himself that they don't exist. What a revelation "Bargain-hunters' Devices, by a Shopkeeper," would be to those who have never seen human nature from his position! How it would show up their little weaknesses, their consideration, their regard for truth, the lack of invention in their methods. Tell you some of their ways! Hardly! I am a tradesman myself, and I don't want to increase the difficulties of business by suggesting new departures from the old well-worn lines, which are so familiar that one recognizes them at a glance. Besides, it would take too much time just now. As all the old upholstery is off the chair now, we can begin with the new. I'll tell you all I can how to do this, which will be sufficient for the present.

The holland directed to be laid when describing the upholstering of a pin-stuffed chair is not required in the one before us, so we can begin at once with the webbing, which by this time you know how to fix. It is tacked down with $\frac{5}{8}$ inch tacks, which will be better than $\frac{1}{2}$ inch in this case, and there is plenty of room for them. They may be either cut or wrought. The latter are much stronger, but they cost a great deal more, and are therefore not so often used. The seat of this chair being larger than those already shown, will require more pieces of web. Three will be enough from side to side, but it will be better to put four from back to front; for, according to our modern ideas, this chair is a very large one. On measuring it we find it is about 22 inches wide across the front by 18 inches at the back, corresponding very nearly with the sizes which Chippendale has stated in his famous "Gentleman's Cabinetmaker's Directory" as being usual in his day, though apparently then as now there was no fixed size, for he tells us that sometimes the dimensions are less to suit the chairs to the rooms. This book is somewhat rare now, but it may be seen at the Art Library of the South Kensington Museum, and those who are interested in old furniture will find the study of it well repay them. In webbing a chair of this kind, the web pincers may be used instead of the strainer, as there is no moulding to be injured. When the webs are fastened, we put down the canvas (Hessian) as before, so that instructions how to do this need not be repeated. In undoing the old upholstery, you probably noticed a quantity of hay round the top of the seat, and as our intention is to work up the upholstery in much the same lines as before, we may proceed to form the hay-roll, as it is termed. Don't despise this kind of seat, for when properly made up it is very durable, and though rather out of date it is not so very long ago since it was the only mode of stuffing known or recognized. Plenty of upholsterers still living remember it as the way by which they were taught to stuff a seat. James Arrowsmith, in his "Paper-Hanger's and Upholsterer's Guide," published in 1851, tells us that upholstery towards the end of last century was plain and simple with the exception of noble, massive, and canopied state beds with formal silk damask hangings; still later, articles in upholstery very plain, moreens in general use. In the best apartments beautiful chintzes often used. Furniture, mostly mahogany, was plain, with little claim to elegance, and "the mode of stuffing seats of chairs, etc., equally simple." The period of the French Revolution opened a new era in the style of furnishing. "The upholsterer had greater call for ingenuity; their (the French) mode of stuffing, a complete change from the English practice, required more than ordinary ability in the workman. . . Whose perseverance and emulation," he adds, "were not wanting to complete success."

Well, to prepare this hay-roll, on the top side of the Hessian draw a line with chalk or pencil, roughly will do, as it is merely to serve as a guide for subsequent stitching. It may be omitted, but it is better

to make the mark. The exact position is not important, but 2½ inches or 3 inches from the edge will be convenient. Now cut a strip some 4 inches wide of Hessian, and sew one edge of it along the line chalked, using stitching twine for the purpose. The stitching need not be very neatly done, all that is required is that it shall be strong. It will be best to use a circular needle, such as is sold for upholsterers, but if this is not easily procurable, a straight one will do. The advantage a circular needle has is that it can be worked through the canvas alone. With a straight one it will be impossible to avoid stitching through the web as well. This, however, is unimportant, but it will make a more workmanlike-looking job if the canvas alone is sewn. In sewing down the strip of Hessian to the foundation no particular care is necessary, the only word of caution I would give is not to pull it too tight when rounding the corners. We shall now want some hay, or, failing this, straw will do; put it under the loose strip sufficiently when this is nailed down at its other edge to form a hard cushion, say a couple of inches high, all round the frame. As the hay is put in pull the strip well over and tack to the outside of the wood, the tacks being driven in fairly close together well home. Of course, the hay must be firmly and evenly distributed without alternate lumps and soft places. It will be better to turn the edges of the strips of canvas in before tacking, as you have already had described.

The hollow left in the centre of the seat may now be filled up with hair or whatever stuffing is intended. Hay should not be used here, its only place being in the roll. It will be unnecessary to repeat in detail how the remaining part of the work is to be done, as the method is exactly the same as described for the pin-stuffed seat. The stringing mentioned for this must, however, be stitched round the roll, otherwise the operations are exactly similar, or rather they may be so, for there are in old chairs slight differences from the modern method. They are, however, so trifling, that for all practical purposes they may be disregarded. The cover should be neatly tacked on underneath the frame and drawn firmly.

Fig. 14 shows another old chair in which the seat is fixed to the frame, not let into it. The mode of stuffing, however, is precisely the same. A double row of brass or copper studs—the latter, though difficult to obtain, being the better, as they do not tarnish so readily—is a very suitable way of finishing off these seats. Chippendale tells us that the studs were frequently arranged to imitate fretwork, but as this is apt to mislead those who do not already know what he meant, I give a few designs of the arrangement of studs similar to some I have seen on old chairs.

It will be seen that the seat of Fig. 15 is very similar in appearance to one of the pin-stuffed shown before, and there is no reason why this form should not be adopted if preferred to the old style, which is not only useful to the amateur, as showing him how to do up old chairs, but as a means by which, with very little skill, he may upholster a good serviceable seat to any chair.

(To be continued.)

WOOD-CARVING IN IRISH BOG OAK.

By ALEXANDER WATT.

II.—Carving a View Brooch (*continued*)—Special Directions for Carving Bog Oak—First Stage of the Operation—How to apply the Tools—Treatment of the Foreground—Finishing the View—Forming the Border.

CARVING A VIEW BROOCH, *continued*.—When the chipping of the outer edge is finished, the small chisel must next be used to cut away as evenly as possible all the remaining surplus wood, and this surface may now be rasped, or trimmed with a coarse file, in the direction of its length, until the pencil, or engraved oval line is approached, after which a smoother, but keen-cutting file, must be employed to make the surface perfectly even all round. In doing this, the operator should see that the oval form at the back is as true as that on the face or upper surface of the wood. It produces a better effect, however, if this outer edge is made to incline a little downward, from front to back, but this should not reduce the back by more than about $\frac{1}{16}$ of an inch. This surface should be finally rubbed with fine glass-paper to remove file marks, when this part of the work is complete. The back must now be rendered smooth, which is most readily accomplished by rubbing this surface upon glass-paper laid upon a perfectly level table, beginning with coarse paper and finishing with fine. The rubbing down of such surfaces should be done *in circles*—not to and fro, and only with moderate pressure, especially when the coarser paper is being used, otherwise deep glass cuts will be formed which will involve extra labour to obliterate with the finer paper. When the back and edge are thus prepared, we may next proceed to the first operation of carving proper—that is, to cut away such portions of the design as are required to be removed to give relief to the more prominent parts of the picture.

In carving the design, several points have to be considered, which must on no account be neglected. 1. Care must be taken when applying the chisel, to leave the pencil outlines untouched until their removal, during the progress of the work becomes

a necessity. 2. We must be careful not to cut deeper than is necessary to produce any given effect. 3. The effects of distance, being produced by cutting "deeper and deeper still," until a limit is reached, care must be observed when approaching the back of the object, not to cut through it. 4. The perspective must be carefully given by forming the side walls and other receding objects at the proper angles. 5. The foremost objects in the foreground, as boulders or large stones, should be scarcely at all reduced from the level of the border, except so far as to cut away portions of the wood from the right or left to give form.

To carve the view brooch shown in Figs. 5 and 6, which represents a ruin known as "St. Patrick's Purgatory," proceed as follows:—1. With small chisel cut away wood at A (for letters, see Fig. 5), keeping within the lines on either side, to depth of about $\frac{1}{8}$ in.; the chisel should then be lightly passed round the two inner surfaces of the broken tower, B, B, up to the pencil line, to give a finish to this part. If the small chisel be found troublesome to use, as the cuttings become deeper, the dog-legged tool, well sharpened, may be employed for this part of the work with advantage. 2. The front of the ruined tower, B, B, may next be reduced with the chisel to the depth of about $\frac{1}{20}$ of an inch. 3. Reduce the castellated tower, A, A, another $\frac{1}{16}$ of an inch. 4. Cut on each side of the capital of each of the two turrets, E, to make them appear round, without at present reducing the depth of the extreme front. 5. Cut down and round off as before, the upright portions of these turrets to the depth of $\frac{1}{16}$ inch. 6. Now cut down the rounded capitals, E, to the extent of $\frac{1}{20}$ of an inch, taking care to preserve the rounded form. 7. The side wall, F, may now be formed by gradually cutting away from front to back to within $\frac{1}{20}$ of an inch of the latter, taking care to reduce the wood in accordance with the angle of perspective. 8. The front wall, D, D, may next be uniformly cut down $\frac{1}{20}$ of an inch, avoiding the uprights at each end, which must be allowed to project a little. The turret, E, may now be reduced a trifle, but its foremost point should project a little from the front wall, D, D. The trees on the right and left may next be attended to, with the aid of the dog-legged tool, thus: hold the tool in a nearly upright position, and pressing hard upon that portion of the wood in which the foliage, etc., are to be indicated, give the tool a rocking motion, by movement of the wrist, until a series of zigzag impressions or cuts are produced all over this surface; now work the tool in the same way, but in opposite and various directions, by which means the zigzag cuts will become broken up and assume irregular and somewhat angular forms which have to pass for foliage. The outer boundary of this part of the tree should also be worked round its edge with the same tool, or small chisel, repeatedly applied with a rocking motion as before to give roundness. Now place the dog-legged tool in the centre of the rugged surface thus produced, and, rocking it to and fro as before, dig out a slight hollow, to break up the comparative flatness of this part of the object; indeed, it is best to make several such indentations or hollows in different directions, to give the effect of light and shade (as in drawing), which a person of taste will readily understand. The stem of the tree is formed by cutting this part down to about $\frac{1}{8}$ of an inch, rounding it on each side, and making it rough all over by scratching with the broken end of a file; one or two small vertical cuts with the graver will improve the effect. The rockwork on the left may be formed by first making this part of the scene rough all over with the dog-legged tool, and then, with the small chisel cutting off angular slices of the wood here and there, to represent flat surfaces of rock as indicated in the engraving, Fig. 6.

We next come to the foreground of the picture, and in the treatment of this we must remember that we have not much depth of material at our disposal for producing very striking perspective effects; we must, therefore, endeavour to make the most of our limited material, and with it produce the highest perspective attainable, so as to give as much relief as possible to the chief object in the scene. This part of work (the foreground) may be treated greatly according to the taste of the carver, and if he has a knowledge of drawing, he will have no difficulty (when he has mastered the use of carving implements) in producing very pleasing effects on this important portion of the design. As a general guide to the uninitiated, we may give the following simple directions, and these, as we have hinted, may be considerably modified at the will of the operator. To give the effect of distance to objects in the background, it is well to form some prominent objects as rocks, for example, on the right of the scene, diminishing them *leftward*, by doing which carefully and artistically the perspective of the picture may be effectively improved.

We would, therefore, in the present instance, introduce some rock-like prominences on the right (as in Fig. 6), giving them a gradual reduction in size, and terminating in indistinct ruggedness. Before doing this, however, the whole of the foreground may advantageously be roughened by employing the dog-legged tool in the manner before suggested, but in doing so we should be careful not to obliterate the outline we have traced in pencil upon this part of the view; indeed, it is a very good practice to lightly pass a graver over all the pencil marks (being careful not

to cut too deep), by doing which we are less liable to lose sight of the outlines.

The rocks on the right may now be represented by cutting angular slices, from $\frac{1}{16}$ to $\frac{1}{8}$ of an inch surface, at the extreme right, between the rock-line and the border *downward;* then form facets or flat angular surfaces in the same way, but of diminishing size, in the direction of the building, until the front wall of the ruin is reached. These facets should be formed right and left, with occasional horizontal cuts of the same character, to represent large fragments of rock, diminishing in size to give the effect of distance. When this part of the foreground work is effectively carried out, the clean cuts of the chisel at various angles will present a series of bright surfaces which will strongly contrast with the more rugged portions of the scene, thus giving the requisite effect of light and shade, and when the completed article is finally polished by a method we shall hereafter describe, a very brilliant effect will be produced, upon which much of the beauty of the scene will depend. The remainder of the foreground, as we advance towards the left of the picture, must be broken up by forming boulders or stones in the same way as directed for the rocks, but these must be placed at irregular distances and diminish in size as we approach the wall of the ruin. The rocks and tree on the left will have to be treated in the manner already described, care being taken to make the facets of the rocks somewhat smaller in surface than those on the right.

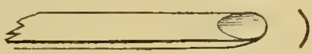


FIG. 7.—SMALL GOUGE.

FIG. 6.—BOG OAK VIEW BROOCH COMPLETED.

Finishing the View.—We must now return to the principal object of the design—the ruin—and endeavour to impart to it a rugged ruin-like appearance. Beginning as before, at the deepest or more distant part of the building, we should first form the divisions in the castellated tower, which may be readily done by means of a small, thin, flat file, but we must take care not to file too low down or the effect will be bad. Having done this, the face or front of this part must be scratched all over, from top to base *horizontally*, with the tip of a small file from which a small fragment has been purposely broken off by means of a pair of pliers: the fine steel points thus left admirably answer the purpose indicated. The broken file, or scratching tool, should be employed in the same way to every part of the ruin, including the walls, by which means all marks of the cutting tools become obliterated, while, at the same time, the building acquires a more rugged and ancient aspect. A few light vertical touches with the graver may now be given to all parts of the ruin, except the castellated or more distant part of the structure, to represent stone-work. Two moderately deep cuts with a small narrow scorper, or the graver, will do for the windows. When all the preceding details have been attended to the view may be considered finished, and we will next turn our attention to the border, or, as it were, frame of the picture.

This important portion of the brooch may be formed in various designs according to taste; we will however, describe some patterns that we adopted many years ago, several of which surrounded a series of bog oak brooches carved by the writer, and exhibited in the Great Exhibition of 1851. The border represented in the engraving (Fig. 6) is not only one of the most simple and easy to manipulate, but to our mind is one of the most effective, since it presents a great contrast to the scene which it surrounds not alone in its outline, but if it be well polished, by virtue of its brightness.

Forming the Border.—To prepare the border referred to for receiving the design in pencil, it should first be bevelled from the inner oval the outer edge to the extent of about $\frac{1}{16}$ of an inch, which is best done with a keen coarse file at first, using a smoother file after; and when the filing is complete a piece of glass-paper wrapped round a flat file or piece of wood and rubbed over the surface, will soon erase all file marks. Fine paper must next be applied with a light hand, and after this the surface may be rendered perfectly bright by burnishing. Any hard and smooth, but narrow surface will do for a burnishing tool—to wit, a bright steel key or even the back of a closed pair of scissors. A proper tool, however, may be readily formed from a piece of bright steel wire $\frac{1}{8}$ inch thick and about 3 inches long, one end of which should be pointed and flattened by filing, and then driven into a graver handle. This tool may be brightened for use at any time by rubbing it upon a piece of hard leather, or wood, upon which a small

quantity of crocus, or jeweller's rouge, is placed. In drawing the outline upon the prepared border, we must first find the centre, and then, placing a straightedge across the view, put a pencil mark on the border, both above and below; between these two marks, at each end of the oval border, two corresponding marks should be made, these must all be accurately equidistant, which may readily be determined by the compass or a strip of paper. This being done, a pencil line should be made at each of the four points where the scrolls meet, but these must also be exactly equidistant, as will be readily understood. The form of each scroll is next to be neatly drawn, after which we may proceed to fashion them. The view being held firmly between the fingers of the left hand, is pressed upright against a table or bench, and a half-round file deftly applied to form the bend of the scroll on each side of the centre point. This must be done neatly, and the small amount of wood to be removed by the file cleared away from front to back. The two corresponding parts of the end scrolls must be formed into shape in the same way. The eight curves of the scrolls will then have to be formed with the file, care being taken, as before, that perfect uniformity is observed in each case. The four intermediate *points* between the scrolls must be filed into shape when rounding the curve of each scroll. To form the curl of the scrolls, we avail ourselves of a small gouge, which may readily be made by the amateur, as follows: Obtain a piece of flat steel, iron, or even brass, about one-eighth inch wide, one-thirty-second inch thick, and about three inches long; point this at one end with a file, and drive it into a small handle; now file the other end, in its width, into the form of an arch; having done this, hold it firmly against a table or bench, flat way up, and slightly round it off with a file; now turn it over, and with a small half-round file form a hollow, about one-eighth inch in length, and just deep enough to enable the tool, when pressed into a piece of soft wood, to make a semicircular mark corresponding to the curved line in Fig. 7, in which, also, a sketch of the blade of the tool is shown. Since this little tool is generally heated before being used, the so-called cutting edge need not be so sharp as in the ordinary gouge. In using this tool to form the curl of the scrolls, the point merely requires to be held in a candle flame for a few moments; it is then held upright, being placed in its proper position on the border—that is, with the hollow facing the operator, and left edge of the tool resting on the points of the curl. Gentle pressure is now given, and by slightly turning the tool between the fingers and thumb, the desired curve or scroll is readily produced. A very little practice, which may be obtained by various trials upon any useless piece of wood (end way of the grain by preference) will soon make the amateur an expert in the use of this simple but useful little implement. When the gouge has been applied as above directed, it frequently happens that the curved impression produced by the tool fails to meet the exact spot where the bend of the scroll should join it; when this is the case, the junction must be completed by means of the graver, taking care to preserve the true form of the pattern. When these latter details have been carried out, the burnishing tool may be passed over those parts where the heated gouge has been applied, but before doing so, any irregularities which may be felt with the finger (and which are due to the swelling of the wood by the hot tool) should be gently rubbed down with a fine file—an old file being preferable. After doing this, the *cold* gouge should be once more passed into the curl of the scroll, as before, to give sharpness, and the burnisher then lightly passed over, so that the now ornamental border may be perfectly smooth and bright over its entire surface.

(*To be continued.*)

A LIME JET AND GASHOLDER FOR AMATEURS.

By ATROPINE.

MY success in producing this useful and instructive apparatus induces me to give the readers of AMATEUR WORK the benefit of my experience.

Construction of Lime Jet.—There are different kinds of oxyhydrogen lime jets, which, however, may be divided into two distinct classes. (1.) The "mixed gas jet," in which the oxygen and hydrogen are mixed before ignition. (2.) The "blow through jet," in which the hydrogen flame is blown on to the lime by means of the oxygen, after the manner of a common blowpipe. The "blow through jet" is the easiest for amateurs to construct, and also the safest, there being little or no danger of explosion when this kind of jet is used with coal gas instead of pure hydrogen. Fig. 1 gives a side elevation of this jet. A is the oxygen tube, B the tube along which the hydrogen or coal gas is conducted, C is the nozzle of the oxygen tube, D is the stopcock of the hydrogen tube, and E, the stopcock of the oxygen tube, stands directly behind it, and is not seen in the elevation. F, G, are the two supports of the rod H, on the end of which the lime is adjusted; K is a disc to keep the lime in place; and L is a milled disc to turn H round with; M is a piece of brass plate to fasten the tube B down to the stand S; N is a short connecting tube joining the hydrogen tube with the stopcock.

A similar disc and brass plate stands behind and connects the oxygen tube with its stopcock. The materials required and their cost are as follows:—1ft. 7in. of $\frac{1}{4}$in. (external diam.) brass tubing, at $1\frac{1}{2}$d. per ft., 3d.; 2 cigar stopcocks at 7d. each, 1s. 2d.; 6ins. of $\frac{3}{16}$in. brass rod, 1d.; 6ins. of $\frac{5}{16}$in. brass rod, 2d.; 1 piece of $\frac{1}{16}$in. sheet brass ($3\frac{1}{2}$ins. by $1\frac{1}{2}$in.), 3d.; 4ins. of $\frac{3}{16}$in. (internal diam.) brass tubing, 2d.; 1 brass blowpipe at 6d.; 1 piece of well-seasoned baywood (9in. by 4in. by $\frac{3}{8}$in.), 2d.; 2 brass screws $\frac{3}{8}$in. long.

As will be seen from the above, the cost of making lime jet is very small compared with its value when a made, the price of an oxyhydrogen jet varying from 18s. to 30s. To proceed to the construction of the jet. Cut off 8 inches from the long piece of brass tubing with a fret-saw, and bend the piece cut off at right angles at $2\frac{1}{2}$ inches from one end. This is best done in the vice, taking care to prevent the tube being crushed by placing pieces of wood between it and the vice. At the end of the long arm of this tube cut a screw thread for about $\frac{1}{4}$ inch. (If the amateur has not got any screwing tackle, all the connections must be soldered.) This tube is for the hydrogen. Screw the remaining 11 inches of tube for about $\frac{1}{4}$ inch. At the other end tap the inside of the tube for $\frac{1}{4}$ inch. Screw a bit of rod into this end of the tube, and cut it off flush with the tube end. Now fix the tube lengthways in the vice, and drill through the plugged end an $\frac{1}{8}$ inch hole into the tube, as shown in Fig. 2. Next bend the tube round at the plugged end, as shown in Fig. 3. Cut the 4 inch piece of tube in half and tap $\frac{1}{4}$ inch, one end of each half to fit the ends of A and B, Fig. 1. Tap the other ends to fit the stopcocks, as shown in Fig. 1. Next cut out from the sheet brass two pieces of shape and size of Fig. 4, and tap the centre holes to fit the screw threads on the tubes A and B, Fig. 1. Screw these on to A and B as far as they will go. Next screw on the short tubes, and into the tubes screw the stopcocks. Cut from the baywood a piece 2 inches long by 3 inches wide for the stand, and one 6 inches by $\frac{3}{4}$ inch. Plane each piece up square and bevel the top edges. Also cut four triangular bits to form feet for the stand, and fasten one to each corner. Cut two slits at 1 inch from one end of the stand, and make the slits $\frac{5}{8}$ inch long, and wide enough to admit the brass slips, as shown in Fig. 5 at B and C. These are best cut with a fret-saw. Now screw the narrow strip of wood to the centre of the stand, so that one end is flush with the slits B and C. Then French polish or varnish the stand. Take the 6 inches of $\frac{3}{16}$ inch brass rod and screw one end for $\frac{3}{4}$ inch (this is to prevent the lime disc from coming loose). Screw a 1-inch disc, cut from the sheet brass, on to the screwed end of the rod as far as it will go. Next fit a small disc, $\frac{1}{2}$ inch diameter, on to the other end of the rod. The edge of the smaller disc will look better milled. Cut two pieces of the $\frac{5}{16}$ inch brass rod off at $2\frac{3}{4}$ inches long. Screw one end of each for $\frac{3}{8}$ inch, and bore a hole $\frac{1}{4}$ inch from the other end through each rod to admit the $\frac{3}{16}$ inch brass rod fairly tightly Screw these rods into the centre piece of the stand at 2 inches from each end, so that the holes in them run parallel with the stand. Unscrew the inch disc from the thin rod, pass the rod through the holes in the brass uprights with the milled disc towards the slits in the stand, and screw the disc on again. If the rod fits at all loosely, it may be tightened by twisting one of the uprights a small way round. This rod forms the limeholder, and by means of it the lime may be either turned round or moved to and from the jet. Cut off the nozzle of the brass blowpipe, together with $\frac{5}{8}$ inch of the tube, and solder it on to the plugged end of the curved oxygen tube, as shown in Fig. 3. Now fit the brass slips that are screwed to the tubes A and B, Fig. 1, through the slits cut in the stand, and see that the jet of the oxygen tube fits just behind, and about $\frac{1}{16}$ inch above the hydrogen tube. Bend the projecting ends of each slip underneath the stand and screw down firm. Fit the two tubes close up against the middle slip on the stand, and keep in position with two $\frac{3}{8}$ inch brass screws. The jet is now finished with the exception of fitting a piece of lime on to the screwed end of the holder. Several discs may be cut out from a small piece of lime with an old saw and rounded with a rasp. Bore holes in the centre of the discs, and tap them to screw on to the limeholder. The discs must be kept in an air-tight canister, to prevent their falling. The construction of a gasholder to contain the oxygen for the use of the jet will be next described, and at the end of this paper the mode of manipulation for the successful working of the jet will be dealt with.

The Construction of the Gasholder.—The kind of gasholder whose construction I intend to deal with is known as the Pepys'. The size here described will not contain enough gas to last any length of time, so that, unless made larger, it will not contain enough gas for a magic lantern exhibition, but will be plenty large enough for use in chemical experiments, and by making it larger it may be used for lantern exhibitions, though not so convenient as a gas-bag. Fig. 6 gives an elevation of the apparatus. A is the body of the holder, and in it the gas is stored up; B is a trough to hold water, by means of which a certain pressure is exerted on the gas in A (the water is admitted into A by means of the pipe C, and its rate of flow regulated by the stopcock F); D, E are two lengths of either iron tube or rod

to support B; K is a short tube opening into A, and can be closed with a cork (by means of this tube the gasholder is filled); G is a stopcock, and is connected with the oxygen tube of the lime jet when the gas in A is being used; H is a gauge to show the amount of gas in A; L, L, L are feet to support the holder; M is a short trough to carry off the water expelled from K when A is being filled with gas. The materials required for construction are: 1. A 4-gallon oil can to form the body of the holder; this will be about 1 foot high when the conical neck is cut off. One of these may be picked up for an old song at any marine store. If, however, not successful in his search, the amateur had better make one of tin plate—1 foot high and 10 inches wide is about the size. 2. A piece of tin plate long enough to encircle the oil can, and 6 inches wide. 3. Also two discs of tin plate each as large as the bottom of the can. 4. 3 feet 6 inches of ½ inch iron gas pipe. 5. Two brass stopcocks, one of which must have two inside screws, and be large enough to screw on to the gaspipe. The other may be smaller, and need not be screwed, as an india-rubber tube will have to be fitted on to one end of it. 6. Two small elbow joints about ½ inch internal diameter. 7. About 1 foot of glass tube, rather less than ½ inch outside diameter, to fit loosely into the elbow joints. 8. A piece of $\frac{1}{16}$ sheet iron, 3 inches by 6 inches. The first thing to be done towards making the gasholder is to cut off the conical top of the oil can, and smooth the top of the can round with a file. Cut a ¾ inch hole in the side of the can close to the bottom. On the opposite side cut a ¼ inch hole about 1 inch from the bottom, and directly above it, and about 1 inch from the top of the can, cut a similar hole. These holes are for the gauge. Close to the top of the cylinder, and about 6 inches from the gauge, cut a ¼ inch hole for the stopcock G (Fig. 6). This must be as near the top of the can as possible. Next from the $\frac{1}{16}$ iron plate cut three pieces of shape and size shown in Fig. 7. Bend each piece along the dotted line A B C, and then bend it along B D till the V part is closed up. These form the feet of the gasholder, and must now be firmly soldered on to the bottom at equal distances from each other. Zinc chloride forms an excellent flux for soldering. It is made by dissolving zinc in hydrochloric acid to saturation and diluting it with water. Black varnish the inside of the oil can. Take one of the circular pieces of tin plate, strike a circle round it at 1½ inches from the edge, and divide it into three equal parts. At one of the points of division bore a hole ½ inch in diameter to fit the iron tubing. Now black varnish and solder the disc on to the top of the oil can. Take the second disc, divide it, and cut a hole through similar to the other. Bend the 6 inch wide piece of tin plate round into a circle, letting the ends overlap about ½ inch, and solder them together. Bend one edge of the cylinder over upon itself for about ¼ inch. Bend the other end of the cylinder at right angles for the same distance; fit the disc into the cylinder against the overturned flange to form a bottom, and solder. From the iron tube cut off a piece 9 inches longer than the height of the oil can. This may be done with a file, but the best way is to use a gaspipe cutter. Cut a small portion away from one end of the tube, about ½ inch high, as shown at A, Fig. 8. This is in order that the tube may rest on the bottom of the oil can, and yet allow water to pass through it into the can. At about 6 inches from the other end of the pipe cut in two, and screw each end at the part cut for about ½ inch to fit the larger stopcock. Screw the stopcock on as shown at F, Fig. 6. An inch, or less, will now have to be cut off the tube to make it exactly 9 inches longer than the height of the oil can. From the remaining piece of tube cut two pieces, each 9 inches long. These are to support the circular trough. Now pass the long tube through the hole in the top of the oil can, letting end A, Fig. 8, rest on the bottom. Solder the tube round the hole in the top of the can, and solder one of the short tubes at each of the two points marked on the end of the cylinder, as shown in Fig. 6. Fasten the circular trough on to the top of the tubes so that the stopcock tube fits under the hole cut in the bottom of the trough. The iron tubes will solder well if rubbed bright, and the zinc chloride be freely used. Over one of the gauge holes in the body of the holder solder one of the elbow joints, and fit it, so that when the glass tube is fitted in it the other end of the tube will be opposite the other gauge hole. Cut the glass tube of such a length so that when the other elbow joint is fitted in its place it will fit into each joint about ¼ inch. Now fit the tube into the fixed elbow joint, and fix the other joint over the other gauge hole, and over the other end of the tube. Now, with the glass tube in place, solder the elbow joint to the holder. This part of the construction requires great care to avoid breaking the glass tube, but if the tube be not allowed to get too hot it will not crack. Now solder the stopcock over the ¼ inch hole in the cylinder. Cut a piece of tin plate, 3½ inches by 2 inches, and bend it into a cylinder, shaping it round a broom handle. The ends must overlap about ¼ inch, and be soldered, and one end of the tube cut off at an angle of 45°. Solder this tube over the ½ inch hole in the cylinder, as shown in Fig. 6 at K, and solder a sloping trough, about 3 inches long, beneath it. Now black varnish the whole affair, leaving the stopcocks bright, and run a thick solution of shellac in spirits of wine round the bottom and top of the gauge, where it fits into the elbow joints, to

make quite air-tight. The gasholder is now complete, and the method of using it is as follows: First, tightly close the short tube K, Fig. 6, with a good cork; an india-rubber one is preferable. Open both stopcocks, and fill the circular trough B with water, and continue the process till the holder is perfectly the oxygen tube, and firmly close K with its cork. Now connect the stopcock G with the oxygen tube of the lime jet by means of a piece of india-rubber tubing. Connect the hydrogen tube with the gas-fittings in the room. Screw one of the lime discs on to the holder. Turn on the hydrogen and ignite it.

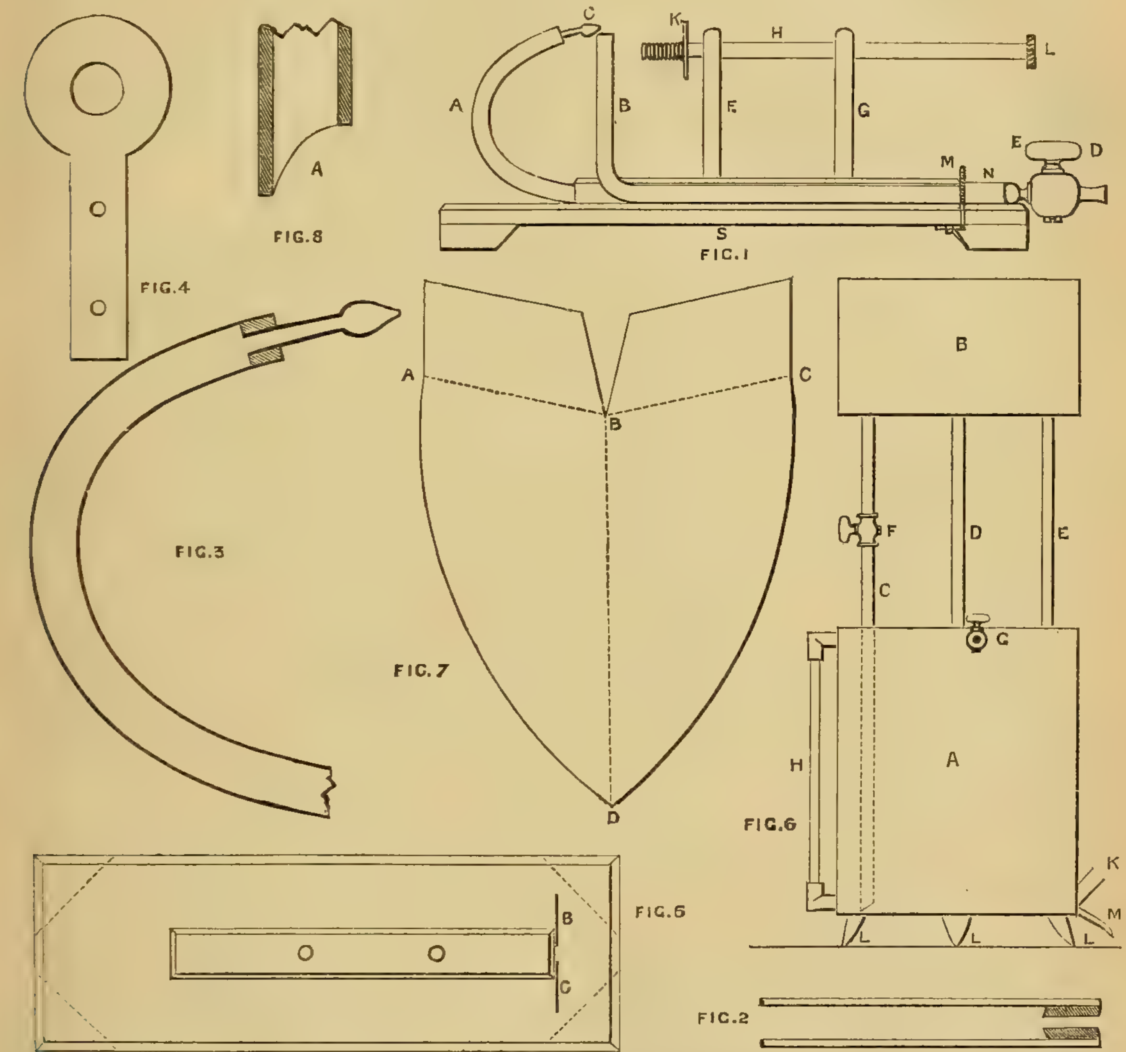


FIG. 1.—SIDE ELEVATION OF LIME JET, ONE-THIRD FULL SIZE. FIG. 2.—OXYGEN TUBE PLUGGED AND DRILLED. FIG. 3.—TUBE BENT IN SEMICIRCULAR FORM. FIG. 4.—SHAPE OF PIECES OF SHEET BRASS. FIG. 5.—WOODEN STAND FOR JET. FIG. 6.—ELEVATION OF GASHOLDER, SCALE $1\frac{1}{2}$ IN. TO 1 FT. FIG. 7.—PATTERN FOR FEET OF GASHOLDER.

full, and water begins to issue from the stopcock G. Now turn off both stopcocks, and take the cork out of the tube K. Pass the tube from the oxygen generator down K into A, and allow the oxygen to bubble into the holder. The water displaced will run down the tin trough M, Fig. 6, and a bucket must be placed to receive it. When the holder is full of gas remove Fill the gasholder trough with water, and turn on the stopcock F (Fig. 6). Now turn on the oxygen, which, being under pressure by the water in the trough, will blow through the hydrogen jet into the lime. As the water in the trough is exhausted it must be replenished. By regulating the supply of oxygen and coal gas, an intensely brilliant light will result.

HOW IT WAS MANAGED.

A SERIES OF PRACTICAL HINTS, SUGGESTIONS, AND WRINKLES.

FROM AMATEURS FOR AMATEURS.

XXXIV.—HOW TO SHOW STATUARY IN THE MAGIC LANTERN.

[*From* FAT.]

TO show statues to perfection, it is necessary to have first-class object glasses to the lanterns; they should be quite free from chromatic and spherical aberration. If they are not achromatic a tinge of prismatic colours will appear round the edge of the figure on the screen and quite spoil the effect. If spherical aberration be not corrected it is impossible to get the centre and edge of the picture in focus at the same time. The lenses I used were Dalmeyer's best carte-de-visite, which fulfilled the above conditions very perfectly, the statues coming out beautifully white and clear and very sharp all over.

To exhibit the slides, place a slide of sky-blue glass in one lantern and dissolve the last slide into it, then place the first of your series of statues into the other slide-holder; dissolve *very* slowly, taking care to leave a slight tinge of blue; the figure will appear beautifully white against a most appropriate background. When you wish to change, dissolve back into the blue slide, change your picture, and proceed as before. The best slides that I have met with for this purpose were by Negretti and Zambra, and were printed by the albumen process.

The effect of the pure white figure, coming apparently out of the blue sky and gradually fading into it again, is very lovely, and must be seen to be appreciated. I first tried ruby glass, thinking it would give warmth to the figure, but it will not bear comparison with the blue glass. I used always to keep the statuary as a *bonne bouche* for the end of the entertainment, and it never failed to "bring down the house."

XXXV.—MOVABLE ELECTRIC ALARUM, AND HOW I MADE IT.

[*From* KING TOM.]

AFTER having seen the Electric Alarum by HARE'S FOOT in Part 63, for February, 1887, I hardly thought that another description of really the same thing would be appreciated; but as the one described there is quite a fixture, I think, perhaps, some readers of AMATEUR WORK would find a portable one, as I shall try to describe, useful, as it is very compact, powerful, and easy to make. I used an alarum clock for some time, but found the ticking of the clock kept me awake, and on putting it into a drawer I found the alarum insufficiently strong to wake me; so I thought the best way out of the difficulty was to arrange a clock in a box with an alarum outside, which I have done, and find it works very well—in fact, it stands, as a rule, on the landing, and wakes everybody in the house.

I will now try to explain how I made and put together my alarum, as best I can. Having had a good look round, I found a box that I thought would do very nicely, measuring 19 inches high, 10 inches wide, and 9 inches deep. I bought a small American clock, to be seen in all American novelty shops from 2s. 6d. upwards; and having the gong of a bell by me, I set to work and made a good size electric bell, which I shall not describe, as it has been done so often in AMATEUR WORK. A similar one could be purchased for 7s. or 8s. I should advise anyone feeling inclined to make one to be careful in choosing a good piece of well-seasoned hardwood, as it will not be affected by the changes of atmosphere so much as soft. If the reader has the Parts of AMATEUR WORK as far back as Part 7, for June, 1882, in page 321 he will find a very good description of an electrical bell and fittings there.

Having finished my bell I fixed it to the top of the box by four brass screws, one at each corner, as in Fig. 2. Then I made a shelf to fit into the box, and cut a circular hole in it just a little smaller than the base of the clock, as I have to wind up and set the hands from underneath, and left a clear 11 inches underneath the battery. I did not fix the shelf, as it is much easier to get at the clock if left loose. Then taking the clock, which had a metal case, I soldered two pieces of zinc (F, F, Fig. 3) to it, and after making two holes in each piece, I fastened the clock to the shelf by means of them with four small screws; and took the glass off the face by filing off the rim of metal that kept the glass in its place a little more than half-way round, and then slid the glass out. Then I made the connecting link, which Fig. 4 represents in *full size*, out of a piece of an ebony umbrella handle (but vulcanite would, of course, do equally well; if the reader uses wood other than ebony, he should take care that it is well seasoned, and that it can be got quite smooth, for any roughness on the surface will interfere with the hour hands passing along it steadily), by cutting it into a strip of $1\frac{1}{2}$ inches long, $\frac{3}{4}$ inch broad, and about $\frac{1}{4}$ inch high, and bevelled out the two sides so as to appear as Fig. 5 when looked along, and sloped the two ends so as not to check the hour hands passing over it more than I could help. I then made a small hole, N, through the thin part, and as near the shoulder as possible, and cut a little groove, M, over the top. Then taking a piece of platinum wire about two inches long, I threaded one end through N, and then up to the top and along the groove, M, and twisted the wire with a pair of pincers so as to make it quite tight and firm, and bent the ends into a loop, P. Then I tapped the wire in the groove, M, with a light hammer, so as to get it well set, and sand-papered the whole of the top in order to get the wire exactly level with the ebony, so as not to check the hour hand in passing along it. I then fixed Fig. 4 to the face of the clock with glue, over VII. on dial, as shown (that being the time I usually want the alarum; but, of course, if I want it at half-past six, I put the clock half-an-hour fast, and so on), the loop being outside, keeping as far away from the centre as the hour hand would allow—that is, so that the point of the hour hand just passed over it. Then I made a hole in the case of the clock, V, and passed a length of gutta-percha covered wire, scraped clean at both ends, and fixed one end to the loop, P, of Fig. 4, and the

other I carried in a coil to the terminal, O. The battery may be bought for about 3s. 6d.; but I think it cost me about 2s. 4d. to make, as follows: I bought a glass jar for 4d., half pound of manganese, half pound of retort carbon, both in lumps about the size of peas, some sal-ammoniac, a porous pot a little higher than the jar, a lead-headed carbon fitted with a binding screw, a little longer than the porous pot, and a zinc rod. Then I put the strip of carbon into the porous pot and filled up the pot within about half an inch of the top with a mixture of manganese and retort carbon, and sealed the porous pot up with pitch, and pierced two holes in it, when cold, with a piece of hot iron wire, and poured a little water into the pot through one of the holes. I then made a half-saturated solution of sal-ammoniac by taking just half as much rain water as I should want to fill the outer jar two-thirds full when the porous pot was standing in it, and dissolved as much sal-ammoniac in it as it would take, and then added another lot of water, then put the porous pot into the jar and the zinc rod at the side, and pour in the sal-ammoniac solution.

The battery being made, I put the door on the box with two brass hinges, and stained the whole with walnut, and sized and varnished all over, putting on the catch, K, and the two handles X, X. I then put the shelf with the clock fixed to it into the box and the battery underneath, and joined up as follows: Having bought some silk-covered copper wire, and cutting off a length I joined one end, previously scraped, to the zinc rod at A, Fig. 1, and carried it in a coil made by winding the wire over a small pencil to the side of the box at B, and up to the shelf and along it to the bottom of the terminal, O. Then I loosened one of the screws at F, Fig. 3, wound the scraped end of another length of wire around it, and screwed it in again, and then carried the wire in a coil to the right-hand side and up, as I did at B to C, and brought it through the top of the box at D, Fig. 2, and then in a coil to the terminal, E. Then I carried another wire from the carbon at G up to the back of the box, through the top at H, Fig. 2, to the terminal, J. I then found that on the hour hand's coming in contact with platinum wire in Fig. 4, the bell rang and continued to do so until the hand had passed over it, which took about a minute and a half. Of course, I had to disconnect the wire at D and E, or H and J, or I had the bell ringing again in the evening when it was not wanted; and finding that taking the wires out of the terminal every morning was rather troublesome, and that the wires got bent and so were sometimes rather awkward to get out of the terminals, I arranged a small switch between the terminals E and J as follows: Taking a piece of watch-spring, I took all the temper out of it by heating it and letting it cool gradually, and then filed it into the shape represented by Fig. 6 in *full size.* At the end, L, I made a hole and fastened a little ebony note to the plate, Z, by means of a small screw, and also made a hole at R, Fig. 6. Then I made a small hole with a bradawl at P, in Fig. 2, just below the base of the bell stand, and also at S and T; and instead of carrying the wire straight from F to D and E, I carried it up from F, along the side as before but coming up the hole at R, Fig. 2. Then I passed a screw through the hole, R, of the plate Z, and screwed it into the hole, R, Fig. 2; so that the screw touched the wire brought from F, and the wire from D to E I brought from the hole I made at S. Then taking two plain brass-headed nails I put one in the hole at S so that it joined with the wire leading to D and E; and the other nail I put in the hole at T, which, of course, is only for uniformity; and put a small brass gimp-pin the other side of the nails at S and T, so that at night when I swing the end, L, of the switch on to the nail at S it cannot get too far over, and so break the current. In the morning I disconnect it by swinging the switch on to T.

I have now explained the principle on which my alarum is constructed, as well as I can, and I hope that every reader who may set to work to make one on my system may have as good a result, and derive as much benefit from his, when finished, as I have had from mine.

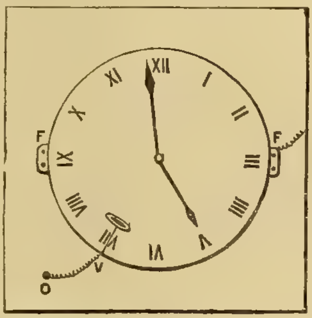


FIG. 3.—CLOCK WITH ZINC FITTINGS SOLDERED TO IT.—Position of Connecting Link shown close to VII. on Dial.

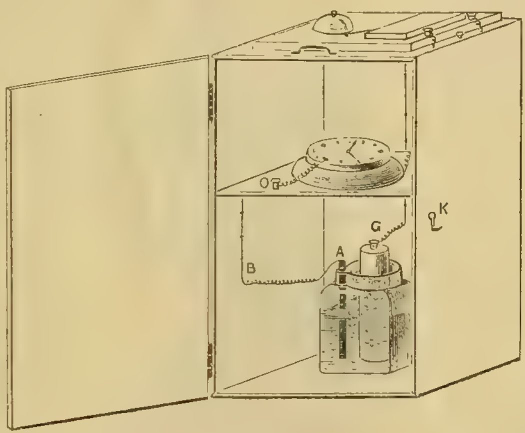


FIG. 1.—MOVABLE ALARUM, COMPLETE.

FIG. 5.

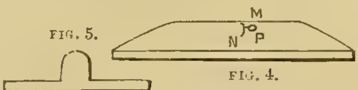


FIG. 4.

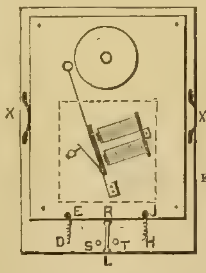


FIG. 2.

FIG. 6.

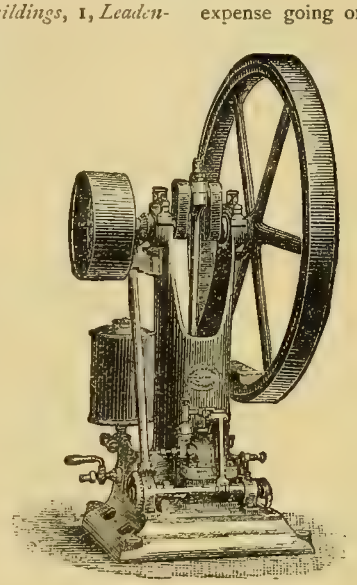
FIG. 2.—MODE OF FIXING BELL. FIG. 4.—CONNECTING LINK. FIG. 5.—SHAPE OF SIDES OF CONNECTING LINK. FIG. 6. — WATCH SPRING SWITCH.

NOTES ON NOVELTIES.

By THE EDITOR.

57. SPIEL'S PATENT PETROLEUM ENGINE. 58. ZILLES' NEW LISTS. 59. CARY'S NEW MUSIC OR LEAF HOLDER.

57. SPIEL'S PATENT PETROLEUM ENGINE. — Many readers of AMATEUR WORK take great interest in motors of all kinds, and these would like to know something about Spiel's Patent Petroleum Engine, which is now being manufactured and supplied by Spiel's Patent Petroleum Engine Company, Limited, in two forms, vertical and horizontal, at the *Suffolk Works*, *Berkley Street*, *Birmingham*, the London office of the Company being at *Leadenhall Buildings*, 1, *Leadenhall Street*, *E.C.* The Single Cylinder Vertical Engine, which is intended for driving chaff-cutters, domestic purposes, blowing organs, and for all the purposes for which small motors are generally used, is the form which would most likely attract the attention of amateurs, as it takes up but little space, and can be mounted on wheels and so made portable at small extra cost. It is of 3-man nominal power, or 1-horse power, effective. The dimensions over all are 3 feet 8 inches high by 1 foot 6 inches wide by 1 foot 6 inches deep. The diameter of the fly-wheel is 2 feet 9 inches, the pulley is 10 inches in diameter and 4 inches in width. Its weight is about 10 cwt., and its price £45 or £46 17s. 6d., if fitted with a tank 3 feet by 1 foot 9 inches. Its general appearance may be gathered from the accompanying illustration. The Single Cylinder Horizontal Engines are made from ½-horse power to 8-horse power, costing from £56 10s. to £235, according to nominal horse power.



SPIEL'S VERTICAL PETROLEUM ENGINE.

The advantages claimed for this engine may be learnt from the Prospectus issued by the Company, which will be sent to any applicant. I have not seen the engine myself, but its principle may be gathered from the following description from the *Times* of the 2-horse power horizontal engine, nominal, working up to 3 horse:—"In general appearance the petroleum engine does not differ greatly from some horizontal types of gas engines, except that it carries a small reservoir above it for the oil. In the present instance, this reservoir contains 2½ gallons of refined petroleum, which is equal to five or six hours' supply. From the reservoir the petroleum is conducted by a pipe to a pump, by which small measured quantities are injected into the cylinder of the engine. The oil is supplied at the rate of about four drops per revolution of the engine (which runs at 120 revolutions per minute), and at a given point is ignited by means of a small spirit lamp. The *modus operandi* may be briefly explained as follows: On its out-stroke the piston draws in a charge of air and petroleum, and on the return stroke it compresses this mixture, which is exploded as the crank passes the back centre. The combustion and expansion of the charge take place at the third stroke, the products of combustion being driven out at the fourth stroke. There is thus one acting stroke in every four, motion being continued during the other three by means of a fly-wheel. Vaporization of the petroleum previous to use does not take place, the engine using it in its fluid condition. In order to keep the cylinder cool it is water jacketed. The petroleum engine presents many points of advantage, being entirely independent of any coal or gas supply. It can be set in motion in a few seconds, simply by lighting the lamp and turning the fly-wheel. The consumption of oil is automatically arranged according to the work required, and when the engine is at rest there is no expense going on—an important point, where the work to be done is intermittent. This engine has been thoroughly tested by Mr. John Hopkinson, C.E., who reports upon it very favourably, and places its working cost at 1½d. per horse power per hour for petroleum, and about ¼d. per horse power per hour for lubricating, when developing its full power. Spiel's engine would seem to be capable of competing satisfactorily with gas engines, even where gas is available, but beyond this there is a wide and promising field for it where gas is not obtainable, and where the steam engine is inadmissible."

58. *Zilles' New Lists.* — Mr. Henry Zilles, 9, *South Street*, *Finsbury*, *London*, *E.C.*, sends me his latest lists, namely, Nos. 30, 32, 33, 34—No. 31 cancelling list, No. 26. These lists are 2d. each, and will be found extremely helpful by every amateur who takes pleasure in fretworking, carving, inlaying, and wood painting. No. 31, I may say, is a list of materials, tools, appliances, and fittings of all kinds, while No. 32 gives representations, in miniature, of many of Mr. Zilles' best designs. Amateurs should procure these lists as they appear, and preserve them for reference.

59. *Cary's New Music or Leaf Holder.*—Mr. Alphonse Cary, Musical Instrument Maker, 47 and 48, *Northbrook Street*, *Newbury*, and 95, *Wardour Street*, *London*, *W.*, sends a specimen pair of his new music or leaf holders, for which he has applied for a patent. The holder consists of a slightly curved tongue of brass, which works on a screw between two brass washers; a third washer, of vulcanized indiarubber, intervening between the inner brass washer and the wood into which the screw enters. This contrivance may be easily fixed to even a very thin strip of wood without fear of splitting it, and by the introduction of the washers with which it is fitted it always remains firm, though easily moved, and is very convenient. These holders, which cost 6d. per pair, should be used by all who make their own music-stands. Lovers of music and musical instruments should obtain Mr. Cary's illustrated price list, a 4to vol. of 148 pp.

AMATEURS IN COUNCIL.

For "Instructions to Contributors and Correspondents," see page 44 of this Volume, or Part 60, page 44.

Repousse Work.

*** It will be noticed that Mr. Standage's series of papers on this subject has been followed immediately by another series, entitled, "Pure Repoussé Work, and How to Do It," by Mr. Lancelot L. Haslope, Author of "Repoussé Work for Amateurs." Perhaps some may liken this procedure to putting colour on colour or metal on metal in Heraldry, a combination which is altogether wrong and inadmissible, and may take the trouble to reproach me for not letting the subject drop for the present. My reasons are simply these:—In the first place Repoussé Work is a very beautiful art, which is deservedly attracting much notice at present, and it is desirable that the instructions on it, which are given in a "Practical Magazine of Construction and Decoration," should be as practical as it is possible to make them. Secondly, Mr. Standage, in his papers, has dwelt more on what has been done by others in past times, and thereby rendered what he wrote more theoretical than practical—indeed, more theoretical than perhaps is altogether desirable or necessary. Mr. Haslope is an expert in the art, and is, and has been for years, constantly at work with his hammer and punch. He is, therefore, able to write from personal experience, and to put forth, in a thoroughly practical manner, the results of the knowledge he has gathered for the benefit of those who would wish to follow in his footsteps. Having said thus much, I call the attention of all readers with much pleasure to the first of Mr. Haslope's articles, in page 410 of this Part, and leave him now to speak for himself, being assured that all who follow his instructions will find in him a most able and a most accomplished teacher.

Mr. H. C. Standage notes the following erratum in his concluding paper on Repoussé Work. In page 341, col. 1, line 30, for "lightest part," read "highest part," and wishes to point out that in Fig. 36 "the letter A refers to the dark ground, *i.e.*, the part shaded in parallel straight lines." The engraving appears intelligible, and Mr. Standage's drawing has been followed as closely as it was possible.

Britannia Company's New Premises.

*** Readers of Amateur Work will kindly note that the Britannia Company have given up their show rooms in *Fenchurch Street*, and have removed to more extensive and commodious premises at 100, *Houndsditch, London, E.C.*

Britannia Company's New Lathe.

*** The new lathe recently brought out by the Britannia Company, and noticed in "Notes on Novelties," page 329 (otherwise Part 66) is known as "No. 8 Lathe."

Five-pointed Pens.

F. J. C. (*Brockley*).—Pens *having five points* for ruling music paper, the five lines being ruled with one stroke of the pen, can be procured at 4d. and 6d. each, of Mr. Alphonse Cary, 95, *Wardour St., London, W.*

Fretcutting.

Mr. James W. Lunt, 70, *Strand Road, Bootle, near Liverpool*, requests me to say that he will execute orders for cutting fretwork.

*** *This is the last notice of this kind that can be given* gratis *in this Magazine. Special Advertising Pages have been opened, by which anyone willing to undertake work of any description may make their announcements, the rate of charge being 5s. for notice of ten lines, or less than ten lines, and 6d. for every additional line beyond ten.*

Photography by Reflection.

H. S.—Never having tried photography by reflection, I cannot say how you would succeed; but I fail to see what advantage you would gain by photographing a reflected image instead of a direct one. You would certainly succeed in including every flaw or speck of dirt on the mirror; and the image thus reflected would doubtless require longer exposure than if taken direct. If you still wish to try the experiment, you will find a couple of diagrams of a reflecting camera in the *Photographic News* of April 1st. If you wish to do away

NEW AMERICAN CAMERA, WITH WHICH NO FOCUSSING CLOTH IS REQUIRED.

with the focussing cloth, the annexed sketch of an American invention will show you an easy method of overcoming the difficulty; moreover, no ground glass is necessary—merely a sheet of white paper. The illustration, I think, explains itself.—C. C. V.

Working of Slide Valve.

Richmond.—The slide valve is worked by two short levers or cranks placed at each end of a spindle situated behind valve-chest, and connected with a cross-head on valve-rod; another crank on the spindle is connected with eccentric. In your drawing, which it is not worth while to engrave, the eccentric end is shown, and the bearings of spindle are not shown, but these may be attached either to the cylinder or bed-plate, according to circumstances. The arrangement will be described in detail in course of articles on Model Engine-Making. —J. P.

Prize Exhibits from "Amateur Work."

W. C. C. (*Highbury*) writes:—"I have very much pleasure in informing you that I carried off the first prize for cabinet work at our recent Industrial Exhibition in Highbury Vale. My exhibits consisted of the "Wall Cabinet" that appeared in Part I. of Amateur Work, the "Lily Overmantel," and "Japanese Cabinet," published in subsequent parts, a "Gothic Clock Case," and a few other small articles. There were seven amateurs besides myself, and two professional cabinetmakers. The total number of exhibitors was 222, and the number of prizes 84. Mine was the principal prize of the exhibition. I have taken in your magazine from its commencement, and I can say that it has been a source of great pleasure to me." [I congratulate W. C. C. on his success, and am glad to learn from him that Amateur Work has so largely contributed to it. W. C. C.'s letter is a link in the chain of the constant and continuous testimony to the utility and value of this Magazine, and the practical instruction it is sought to convey in its pages. I am in a position to add that measures are now being taken, which will, I am sure, tend to strengthen the position it has obtained among serial publications of an educational character, and to render it more particularly useful to *beginners* in various handicrafts as well as to those who have mastered the A B C of the work they have adopted as their hobby, and are attaining the position of skilful, if not skilled, hands.—Ed.]

Naxos Union Company.

W. G. N. (*Derby*).—I am obliged to you for the advertisement of the Naxos Union Company, cut from a Berlin trade journal. There is, however, but *one* company of this name, and you and Stadt Dresden are mistaken in imagining that there are other companies trading under this name. Messrs. Buck and Hickman, 280 and 281, *Whitechapel Road, London, E.*, are, as I have stated in "Notes on Novelties," page 380, the *sole agents* for the *home trade* in the United Kingdom. The address of the London firm given in the Berlin paper is the address of the firm controlling the *Export* trade, the Naxos Union Company in this respect following the continental system of appointing one firm as agent for the Home trade, and another for the Export trade.

Wiring Bird Cage.

J. R. (*Burnley*).—It is not possible to determine the difficulty in pulling wires to the design in question without seeing it. Send the design and mark the parts which you find difficult, and you shall have assistance from a contributor who has had some experience in the work.

Dry Plates for Miniature Camera.

C. E. F. (*Preston*).—If your miniature camera is by Marion, they supply dry plates for it, but I think the sizes they make are 1¼ inch by 1¼ inch, and 2 inches by 2 inches. The size you mention (2⅛ inches by 1⅝ inch) is quarter of a quarter-plate (4¼ inches by 3¼ inches). Your best plan would be to purchase the plates, quarter-plate size, and cut them in four with a diamond, doing this, of course, in a perfectly non-actinic light. If your camera is one of those cardboard toys supplied at 3s. 6d., I should not advise you to waste more money on plates, but use your apparatus to light the fire with, or make it into a cage for white mice.—C. C. V.

Amateur Mechanics' Association.

THE BRITANNIA COMPANY (*Colchester*), writes: "We observe in the May Part (Part 66) of AMATEUR WORK some allusions to technical classes. This is naturally a most important matter, and the subject is only now getting attention. Our rising generation of mechanics will be at a disadvantage, compared with the German and other foreigners. But the thing can only be carried out by Government, as the expense of rent, instruction, tools (at first starting), are serious, especially when a limited number only join. We have recently removed into very spacious, light and airy premises in (100) *Houndsditch*, and have two good floors, well lighted, to let at a moderate rent. We have some idea of trying to get one of the City Company's to hire them of us, and let us take charge of the classes under their supervision, they appointing the instructor, if necessary. The shops have large windows, looking out on a rather open space, and the premises are splendidly drained, etc., etc., and situation central. Middle class boys might, if sufficient number join, pay expenses of a class. We could work it more reasonably than many, because we can fill up the man's time. We propose one shop for wood, and one for metal work. Your correspondent at *St. Helena* has hit upon something very much wanted—viz., designs for a variety of things to be made in the lathe. Many an owner of a lathe gets to his wits' end to know *what next*. Many might contribute notions and designs—we would do some if you wish it. We congratulate you upon a capital Number this month. In reference to the A B C of turning, in this month's AMATEUR WORK, the writer gave his nephew a lathe and a book. But as the boy had never had any experience, he found *great difficulty*, owing to the technical terms, which were a foreign language to him. This decided us to get a turning book written which should be *quite easily understood*, by using simple illustrations and as few technicalities as possible. The book is written, and will appear shortly, but we keep adding. We now want to add a chapter on screw cutting, so as to make it a more acceptable book to more advanced turners. We have always new items, but writer's time is so much occupied that details do not get written, he being the only acting partner, and frequently in London. Your correspondent, STADT, is a random shot, and your corrections will make him more careful, perhaps. Is he not identical with SHAKESPEAR, who writes in *English Mechanic* and in AMATEUR WORK? He sometimes is asking questions about things which nearly every one knows, and at others, assumes to teach in a most sage and authoritative manner."

THE REV. JAMES LUKIN writes: "I was from home when AMATEUR WORK arrived, but it so happened that as I passed through London, I looked in at 100, *Houndsditch*, and inspected the new showrooms of the Britannia Company. I said to myself, 'This is the very place for workshops for an Amateur Mechanical Society;' plenty of good floor room upstairs and down—room for all kinds of machines, lathes, shaping planers, and drills, and the Britannia Company are, I find, amenable to persuasion. They will fit up a complete workshop, and provide efficient teaching, if sufficient subscribers make application. The fee would be purposely made as low as possible, so as to meet all pockets; but, of course, machines cost money, and the wages of a good instructor have to be met. But such a workshop as is contemplated will be available for those who have no room in their own homes, and who are unable to purchase machinery. They will, moreover, and it is a great point, be taught not by an amateur, but by a skilled workman, able to show them the way in which mechanical work is done by professionals. Such teaching supersedes all book instruction, and is of immeasurably greater value. Students can also compare, in this case, lathes of every variety of pattern, and learn practically which is best suited for any special class of work. The only regret is, that Londoners alone will be able to take advantage of this offer. Names should be sent to T. M. Bear, Britannia Company, *Colchester*."

C. H. (*Neath*) writes: "Although one of your numberless 'Constant Subscribers,' I have hitherto been a silent member, partly because when questions have been asked there has always been a reader promptly to the front with a response, and also because I must confess to have had some reluctance to try and 'rush into print;' but the importance of the subject is not to be underrated, and having devoted much time to its consideration, I venture to lay before you the outline of a scheme for an Amateur Mechanics' Association, to which I shall be glad if you would draw the attention of Mr. THOS. SYER, and A. F. C. (*Bombay*), whose remarks have been the prime cause of the present communication. There is undoubtedly a great want of the technical schools, which exist in every European country *except* Great Britain, and to fill up this gap to the satisfaction of those among us who desire to cultivate the arts, mechanical and natural, there should be an Association in all our great towns; but this being as yet, unfortunately, unattainable, it remains to be considered in what manner an Association in *London* might be made serviceable, not alone to members resident in the metropolis, but also to their less blest 'country cousins.' The suggestions of A. F. C. are in the right direction, and Mr. THOS. SYER follows with an offer which it remains with your subscribers to entertain, if they can be brought to see the utility, and *entire feasibility*, of such an association as the writer would advocate. Briefly to analyse the direct aim of this association, it may be summarized as 'an Association for the promotion of social industry and a knowledge of the arts mechanical.' The other objects to be compassed by the Association would be—1st, The establishment of an annual exhibition of work, the exclusive proceeds of amateur industry, for which prizes would be awarded and certificates of merit in all branches of mechanical art. 2nd, The opening of a permanent gallery or bazaar in connection with the Association for the *sale of amateur work exclusively*, certain restrictions being in all cases imposed upon the vendors, with a view to the Association becoming self-supporting, as will be hereafter shown. MR. SYER is evidently of opinion that a guarantee fund would be necessary, but why should not the subscribers to your periodical become *their own guarantors*, I ask? I would venture to suggest that a poll be taken by you, sir, inviting your subscribers to sign a vote form for or against the prospectus or scheme, which would be issued with the vote paper. The substance of the proposal would be that each subscriber desirous of becoming a member of the Amateur Mechanics' Association should agree to pay, say, £1 1s. per annum, with an extra entrance fee of, say, 10s., or even £1; votes to be in by a certain date, when it could be ascertained what amount of support the movement would be likely to receive from your readers and their friends. Now, as regards the sale of articles. There are many of your readers who would be glad to dispose of their 'creations' at a reasonable price, which would recoup them for outlay on materials, if not always for time spent, and thus enable them to extend their labours further afield. A percentage of the sale figure should be levied on all such sales, and subscribers to the Association might pay an extra 2s. 6d. or 5s. per annum for the use of the sale room. The person in charge of the sale room should be vested with discretionary power in respect of the acceptance or refusal of goods for exposure for sale. These fees, together with annual subscriptions and the proceeds of exhibitions, should alone fully maintain the Association. The control of the Association would be vested in a committee elected by the subscribers at large. There should be an organizing secretary, who should be the only *paid* official (at least to commence with), and whose whole time should be devoted to the affairs of the Association. It would be premature on my part to enter into figures, which, however, I am prepared to do on some future occasion, if required; and, besides, I find that I have already allowed a feeling of enthusiasm for the subject to carry me far beyond the limits of your just endurance. In conclusion, sir, permit me to suggest that the question is one worthy of your aid, and can scarcely bear fruit until such influence as AMATEUR WORK can bring to bear, is put in force. If my idea has your approbation, perhaps, as it is too lengthy for print, it might find its way to Mr. SYER, who may certainly put down for a subscriber, sir, your obedient servant, THE WRITER."

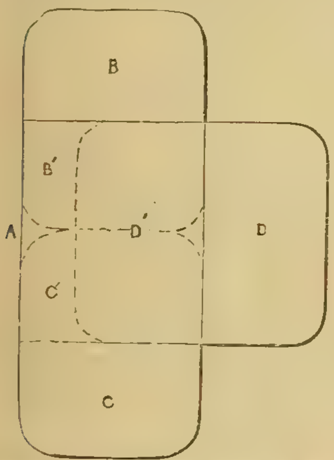
Works on Gilding.

NIL DESPERANDUM.—Books on this art are somewhat rare—in fact, there is no good work which treats on the subject in a practical and exhaustive manner. The following are very handy volumes: (1) "The Practical Carver and Gilder's Guide and Picture Frame Maker's Companion," containing instructions in gilding picture and looking-glass frames, re-gilding old work, decorative gilding, mount cutting, and various other processes and receipts. (*London*: Kent and Co., 23, *Paternoster Row*), price 2s. 6d. (2) "Carver and

Gilder's Design Book," for Decorative Furniture, by Lorenzo Booth. (J. Calvert, 99, *Great Jackson Street, Manchester*), price 20s. (3) "The Carriage Painter's Illustrated Manual." Improvements in fine painting, gilding, bronzing, lettering, scrolling, and ornamenting, by T. B. Gardner. (Calvert, *Manchester*), price 5s. The several volumes of "The Journal of Decorative Art" contain much valuable information on gilding.—H. L. B.

Binding Folding Sheets.

GROOVED BARREL writes:—"Will you pardon my suggestion about AMATEUR WORK, a work truly useful, and highly valued by myself and many of my friends who take it in. At present the beautiful large Folding Sheet Supplements, containing so much that is useful, ornamental, and indeed, beautiful in design, are placed so in the volumes that should you open out the Supplement, and turn to its description, you can only see the back of the Supplement, and not the illustrations, to see which you have to close the book and turn over the Supplement. Might I take



MODE OF PRESERVING SUPPLEMENTS TO "AMATEUR WORK" IN BOUND VOLUMES.

A, Inside of cover at end of Vol.; B, C, D, Flaps attached to cover extended; B′, C′, D′, Flaps folded on inside of cover.

the liberty to suggest that the Supplement be put in so that when you open the book and the Supplement you can see the drawings, and without turning it over, read the description of it, and refer to it without any trouble, *i.e.*, instead of the left hand side of the Supplement being pasted in, the right hand side be pasted in, with the drawings facing inwards, so that when you open it you have the picture facing you on the left while you refer to its description in the pages of the work on the right." [I will represent the matter to the publishers, and I am sure they will meet your views if possible. Meanwhile let me recommend you and your friends in India, and readers of AMATEUR WORK in all parts of the world, if they procure the Magazine in monthly parts, and bind them or have them bound, not to have the Folding Sheets bound in the volumes in juxtaposition with the descriptive text, but to keep them loose in a portfolio, if I may call it so, formed by three flaps attached to the top, bottom, and side of the cover at the end of the volume, as shown in the annexed diagram. The Supplements are placed on the inner side of the cover, and the flaps folded down on them, as shown by the dotted lines. By adopting this plan they are kept clean and safe, and can be taken out at pleasure and placed before the reader for reference when reading the descriptive text, or for tracing, etc.—ED.]

Electrotyping.

R. U. (*Dalton-in-Furness*).—In order to render fragile objects, such as leaves, insects, etc, as conductive as possible when the ordinary process of plumbagoing is out of the question, proceed as follows: First attach the object (for instance, a rose) to a copper wire, then dip it in a weak solution of nitrate of silver (forty grains of nitrate dissolved in an ounce of distilled water), after which, let it drain for a short time, and then expose it to the vapour of phosphorus. To do this, take a small piece of phosphorus and place it in a watch glass containing a little alcohol, locate this over a saucer filled with hot sand, supporting the object by means of its wire over the phosphorus, and in such a manner that it cannot shift or get displaced; now cover the whole with a glass shade of sufficient size, and allow it to remain undisturbed for about an hour, by which time the silver will be found to be reduced to its metallic state, thus rendering the object a conductor of electricity; it may then be immersed in the bath very carefully, and if it is too light, and liable to float, make a loop in the conducting wire, and attach a bullet or similar leaden weight, by means of a piece of twine. By this means, light objects may easily be sunk in the bath until properly coated. A good bronze tint may be given to the objects by dipping them in a weak solution of chloride of platinum (one grain to the ounce of water), and then rinsing them in hot water as soon as the desired tint has been reached. The tone can be varied, from an olive brown to a deep black, according to the quantity of platinum salt used. Another method is to dip the objects in a solution containing a few grains (I generally find five to the ounce of water sufficient, the solution should be filtered before use) of sulphide of barium, the tone being regulated by the time it is allowed to remain in the solution; being removed the instant the desired shade is reached, and then placed in clean water and well rinsed. The blacklead employed for electrotype purposes should be of the finest quality, and procured either from an operative chemist's or a scientific instrument maker's. The household varieties are almost always bad conductors, with the exception, perhaps, of Nixey's, but even this is not fit for good work. The best will undoubtedly be found the cheapest in the end, as it will cover a larger surface. It may be applied either wet or dry by means of a soft camel-hair brush, working it in circles, and never stopping until a uniform bright metallic lustre has been obtained. Breathing upon the mould will generally be found sufficient to cause it to adhe but the finest plumbago is never much trouble to work into the mould as the commoner varieties.—C. A. P.

Hooked Turning Tool.

GROOVED BARREL.—In reply to your inquiry with respect to the use of the hook-shaped turning tool, illustrated Fig. 1, it is intended for wood turning and for use in the slide-rest. It is held in the tool-holder, A, of slide-rest shown in Fig. 2, being secured by means of the clamping-screws,

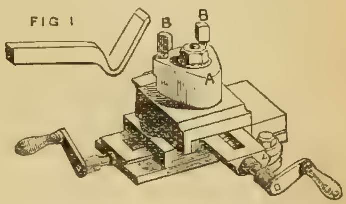
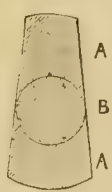


FIG. 1.—HOOKED TURNING TOOL. FIG. 2.—BRITANNIA COMPANY'S NEW COMPOUND SLIDE-REST.

B, B. The slide-rest illustrated here is the "New Compound Slide-Rest" of the Britannia Company, and is made in a variety of sizes to suit lathes from 2½ in. to 8 in. centre; and supplied at prices ranging from £2 to £8, according to size. The Britannia Company also make and supply cheap and efficient sets of slide-rest tools of the best quality, which you will find described and illustrated in Vol. V., page 329, otherwise Part 54, dated May, 1886.

Kelner and Solid Eye-pieces.

TRIO.—The Kelner Eye-piece is an achromatic combination which secures a wide field of view. The principle of construction is somewhat similar to that of the Hughenian described in the papers. It would be out of TRIO's power to construct the lenses. If he only wants the theory, I will furnish it with a sketch; but I fear it will be of no practical use to him. The Solid Eye-piece consists, as the name implies, of a solid mass of glass, achromatised by placing on either side of a sphere of crown glass, meniscus cylindrical lenses of flint, as in the accompanying diagram. The making of this eye-piece is also beyond the power of the ordinary amateur optician; it demands high professional skill. The glasses are cemented together with Canada balsam. The eye-piece described in my papers, to wit, the Ramsden and Hughenian, will serve for all the ordinary astronomical purposes. Those mentioned by the querist are luxuries.—E. A. F.



SOLID EYE-PIECE.

A, Flint Meniscus Lenses; B, Crown Sphere.

Electric Gas Lighter.

W. G. N. (*Derby*).—I have a paper in hand by Mr. Edwinson on the construction of an Electric Gas Lighter, but with regard to those mentioned in your letter, and sold, as you say, at 12s. 6d., Messrs. Buck and Hickman, 280 and 281, *Whitechapel Road, London, E.*, will supply you with one of ordinary size for 10s. 6d.

Small Windmill.

Alpha.—A brief account of a small windmill, with illustrations, is given in Vol. II., pages 513 and 514 (otherwise Part 22) of this magazine, but the subject has not been fully treated, and I shall be glad to hear from any correspondent who has had practical experience in the construction of small windmills, and therefore in the application of wind as a motive power for various purposes for which a motor is required.

Bookbinding.

H. B. (*Jarrow*). — We will not discuss Ruskin, but I may say briefly that I much prefer the genuine article to the imitation when it can be used with due regard to cost, etc. For example, I would rather see panels veneered with fancy woods than painted in imitation of them. It would be as easy to produce papers for bookbinding in imitation of fancy woods, as the papers known as "marbled" papers. It is only a matter of colouring, as the process would be the same in any case. In taking the sheets of your Parts of the Magazine apart, do not soak the backs to remove paper and glue, but after having torn away all that will come off easily, separate the sheets with a thin paper-knife. You must take the sheets (or sections as you call them) apart, or you will never make a good job of your bookbinding. End papers are the papers that are pasted, by way of finish, on the inside of the covers. They are generally coloured, but frequently in books issued bound in cloth, publishers make use of them as a medium for advertisements. To gild cloth, or to impress letters, etc., on cloth in gold, lay the gold on the cloth and apply the heated iron stamp as in other cases. You are right in your surmise respecting the identity of the writer, who has used the two *noms-de-plume* that you mention. The change of name was something like that of the ostrich, who sticks his head in the sand to escape detection. The name of the town gives the clue.

Model for Violoncello.

R. G. (*Cork*).—I am sorry for the delay that has arisen in answering your communication, but it has resulted in an arrangement with Mr. Smith to give in the next volume a half model of a violoncello, with a brief paper explaining its working.

Organ Building.

Thomas. — The papers by Mr. Mark Wicks, entitled, "Organ Building for Amateurs," appeared in Vols. II. and III. of this Magazine, otherwise in Parts 12, 13, 15, 16, 17, 19, 21, 22, 25, 27, 28, 29, 30, 31, 34, and 35. All Parts are on sale at 6d. each

Smallest Open Diapason.

Viol di Gamba.—The smallest Open Diapason I could recommend would be 2¾ inches diameter. Width of mouth and all other dimensions, the same as given in Amateur Work, Parts 12 and 13. Part 12 is the commencement of Vol. II., and in this and the following volume you will get full instructions on Organ Building.—M. W.

Glass Discs.

Trio.—For glass discs of any description try Chance Bros., of *Birmingham*, who are famed for optic glass. But remember, the glass required for a speculum is only common plate, and that discs cut from polished plate offer the safest basis for the manufacture of specula by the main process described in the papers published in Vol. V. Any wholesale dealer in glass will obtain what you may want if you order it. —E. A. F.

Cutting Uppers of Boots, etc.

J. S. (*Glasgow*).—It is not possible to answer your inquiries in the compass of a reply in "Amateurs in Council," but to meet the wishes of yourself and other correspondents, a paper has been arranged for on the method to be followed in cutting the uppers of boots and shoes, which will form a useful supplement to the papers that have already appeared in "Boot and Shoe Making."

INFORMATION SUPPLIED.

Electric Gas Lighter.

Mr. Edwinson writes in reply to King Tom:—"An electric gas lighter now used in large shops, factories, and warehouses, is sold at 17s. 6d., under the name of 'Patent or Portable Gas Lighter.' It is a patented arrangement for causing a current of static electricity to discharge a stream of sparks between two points of metal at the end of a rod. The arrangement may be thus briefly described: A cylinder of ebonite, 5 inches by 2 inches, encloses a smaller ebonite cylinder fitted with a ratchet and spring attachment, and suitable collectors and conductors. By pressing a metal button on the side of the outer cylinder, the inner cylinder is made to revolve rapidly, and generate a current of static electricity; this is carried by a suitable conductor to the end of a metal rod, and is there discharged between two metal points. The length of the metal conducting rod may be anything from 12 inches to 36 inches, as required. A small initial charge is given to the instrument by rubbing the outer cylinder with a coat sleeve, then work the inner cylinder by pressing the button, and at the same time span the points with a bit of metal. After a few minutes, sparks will pass from one point to the other, and then any number of gas jets may be lit with the sparks whilst the instrument is held in the hand and worked by pressure on the button with the thumb. It is said to wear for a long time before it gets out of repair. It is sold by Messrs. H. and E. J. Dale, 26, *Ludgate Hill, London, E.C.*, and other dealers in electric apparatus. Messrs. Dale also fit up a machine for lighting any number of gas jets in the roof of a church, chapel, or hall. A small electric machine, enclosed in a box, is made to generate a charge of electricity, and this is conducted to the gas jets, where it is discharged in a shower of sparks by simply pressing a button on the box. A similar effect can be produced by the secondary current from a small induction coil, worked by a Leclanché battery. If you wish to know how to construct an electric gas lighter, I shall have pleasure in writing an illustrated description of one."

Melting Point of Antimony.

Mr. Edwinson writes:—"Many thanks to Stadt Dresden for his kindly notice of the mistake. It was indeed a slip of the pen. 1150° was copied in error from a manuscript note on melting points of metals. Mr. Bloxham gives the melting point of antimony as 800° Fah., and says—'At a higher temperature it gives off much vapour, which produces a thick white smoke of oxide of antimony.'"

INFORMATION SOUGHT.

Waterpot and Oil Tin Bodies.

H. S. W. (*Newport, Mon.*) writes:—"Could you kindly inform me whether waterpot and oil tin bodies are made the same size, if not, what is the difference? I should like to see some papers on Tin Plate Working in Amateur Work." [Arrangements are pending for papers on Tin Plate Working.—Ed.]

Materials for Solder—Where to Buy.

S. O. B. asks:—Can any one tell me where I may procure a small quantity of tin and bismuth for making solder, as I am unable to procure any here? [S. O. B. does not say where "here" is. He should have mentioned the locality in which he lives.—Ed.]

Wood Dulcimer.

W. F. (*Leeds*) writes:—"I have several times heard performers upon a kind of dulcimer (I should say it is American from its nature), made of pieces of pine wood laid upon straw, and played with hammers. Could any reader of Amateur Work give me particulars about the construction and cost of a similar instrument?"

Vehicle Moved by Spring.

Jack writes:—"I feel exceedinly thankful to Stadt Dresden for rep'ying to my inquiry in Part 60, regarding a vehicle moved by spring. Will Stadt Dresden kindly give the necessary instructions for building such a vehicle. Any information that would enable me to do so will be thankfully received.

ADDRESSES WANTED.

J. W. S. (*Orkney*) is again requested to be kind enough to send his name and full address, as the Editor has a letter for him.

Mr D. Hughes, Engineer and Mechanical Modeller, late of the firm of Hughes and Swift, 17, *Smith Street, Kirkdale, Liverpool*, writes to a customer in execution of an order—"I may say that the above firm is no longer in existence, and the premises in Kirkdale Vale are closed" He omits to give his present address, which should be sent to the Editor for publication in this Magazine, to prevent the miscarriage of any orders that may be sent to him.

LETTERS RECEIVED UP TO JUNE 1.

R. W. W.—Your question was sent to the writer of the article on the Dulcimer. No reply has reached me from him, nor has my letter to him been returned. Kindly repeat your query.

Blast; A Young Binder; H. P. N. (*Belfast*); Trio; H. G. R. (*Sunderland*); G. M. (*Dublin*); Amateur; D. B. A.; J. J. M. (*Holywood*); Amicus; F. S. P.; Alpha; C. F. J. F. (*Hammersmith*).

A GAS-BURNING READING LAMP.

By W. F. P.

THOSE who, like myself, read and write much after dark, will welcome this little addition to the study table as a very great help to their eyes; and the expense and difficulty in constructing an effective lamp of this description will be as nothing compared with the comfort and comparative rest which the full, soft, steady light emitted by it will afford.

A lathe of the most moderate capabilities, with a few simple mechanical additions, and a moderate share of manipulative skill in wood turning, are all that will be required. The amateur must first of all select a thoroughly seasoned stick of oak or mahogany, about 12 inches long and 3 inches in diameter; mount it by means of a cross-bladed or three-pronged chuck and the back-centre in the lathe; turn it up to a very rough cylinder, and square off the two ends. A shoulder must then be cut (at the back-centre end preferably) about $1\frac{1}{2}$ inch long and 1 inch in diameter, and on this shoulder a screw thread must be chased. This is a matter often somewhat beyond the capabilities of the amateur turner, who should, nevertheless, not rest till the art is acquired. I taught myself from reading a description of the method as detailed in "Turning for Amateurs," a book to which I am greatly indebted for many an excellent suggestion; and when once the art was mastered I never lost it. If, however, screw chasing by hand is too great a *bête noire* for the beginner, the shoulder can either be left plain or turned to some standard size, and afterwards cut with a wood screw die and tap; but in the latter event great care must be taken that the face of the die-box finishes quite flush with all parts of the shoulder, or else the column of the lamp will be out of the perpendicular. The cylinder may now be taken from the lathe and laid aside till the base is ready for it. The base should be of a carefully selected piece of hard oak or mahogany about 2 or $2\frac{1}{2}$ inches thick and 7 inches square. A circle should be struck on the face of this, and the corners cut off with the saw and chisel to save labour in the lathe; a hole should be bored in the centre, and the block then mounted on a taper screw chuck with a face-plate, or a slotted face-plate may be used, through the back of which three wood screws are passed into the wood block; in this case great care must be taken that the screws are short enough and near enough to the centre to be out of the way when the moulding comes to be worked. The turner now places his T-rest close up to, and across the face of, the wood, and, commencing at the centre, works the moulding cleanly and accurately with gouge and chisel till the base has somewhat the appearance indicated in Figs. 1 and 2. A hole is then bored by means of the gouge in the centre of the face of the work, about $\frac{3}{4}$ inches in diameter, and the female screw thread chased inside this. When the thread is once satisfactorily formed, the male screw on the cylinder previously prepared must be continually tried in it till it will work somewhat easily, and will screw up with its shoulder touching the base at every point. This accomplished, the base may be released from the chuck and laid aside.

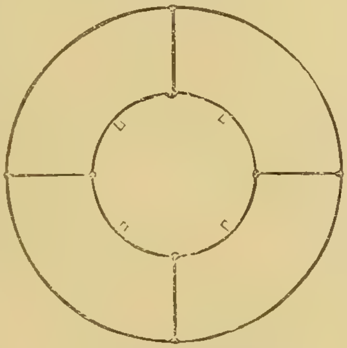


FIG 4.—WIRE CARRIER FOR SHADE—PLAN.

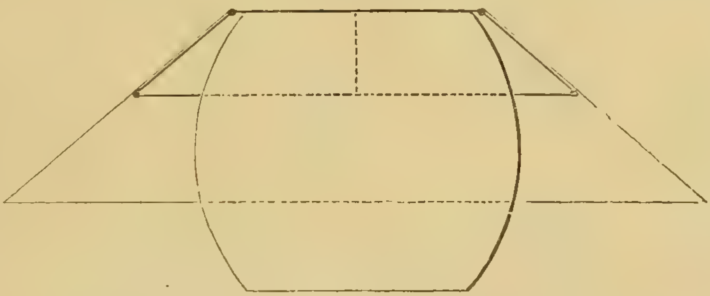


FIG. 5.—WIRE CARRIER FOR SHADE, AND SHADE ON CARRIER—SECTION.

A short piece of beech or other hard wood must now be driven into a cup chuck, turned up true, and chased with the same male chaser which was used for the pillar, till a screw is formed small enough to carry the base. The base may next be screwed on to this temporary screw chuck with the turned side nearest the headstock of the lathe so that a cavity, shaped somewhat after that shown in section in Fig. 2 (shaded dark), may be formed. Great care must be taken in turning this cavity that there is sufficient wood left around the screw-hole, so that the base may not split when afterwards it is fixed to the pedestal.

Having finished the base, it may be firmly screwed on to the upper part of the pedestal, and the whole column then mounted in the lathe between a

face-plate and the back-centre. The best chuck to use here is a self-centring four-jawed one; but as it is not every one who can afford this luxury, any makeshift can be used which will effect the purpose. If a face-plate is used, care must be taken that it has a hole in its centre, or else in the subsequent boring the borer will be damaged. A face-plate, with four small wood screws passing through it into the base, will, in the absence of a jawed chuck, be found to answer very fairly.

The mouldings on the pillar may now be turned, as in Fig. 1, and the top end shaped to fit easily into one of the holes of a boring cone plate, which now takes the place of the back-centre. A long half-round boring shell auger to bore a $\frac{3}{8}$ inch hole must now be used to bore the central hole for the gas-pipe. This boring is much easier in practice than it appears. A start must be made by the gouge to form a conical hole about an inch deep; then, with the lathe working at a quick and steady rate, the auger must be gradually introduced into this hole and steadily pressed till it has made its way right through to the face-plate at the base end. The T handle of the auger should be grasped firmly in both hands, and the flat-topped T-rest should be placed on the outside of the boring-plate to keep the auger as steady as possible. Remember that the least unsteadiness and deviation from the centre may result in a breakage to both auger and work. The gas-pipe hole once bored, the wood may be finished up, all beadings and flats turned true and clean, and, finally, the whole touched with the finest glass-paper, a used piece being better than a new sheet for this purpose.

The exterior parts being now nearly complete, the lead weight to fill the cavity in the base must next be made. To do this a cavity, similar in all respects to the one in the base, must be turned in a piece of common wood, the face of this made true, and a piece of thin board screwed on to it to form a mould, a hole being left at one edge through which to pour the lead. A sufficient weight of lead is then melted in a ladle and poured into the mould, which is then allowed to cool. When cold the casting is taken out, mounted in the lathe on a taper screw chuck, and turned up to shape with a gouge, as if it were a piece of hard wood, till it fits the cavity in the base fairly accurately. A hole is bored through its centre, and a groove sawn with an old hack saw, to allow the pipe to pass through the base. The lead weight is then fastened to the base by four small screws passing into the woodwork.

The gas-pipe may next be prepared. Take a piece of $\frac{3}{8}$ inch brass pipe long enough to pass up the hole and stand about $\frac{1}{2}$ inch above the top of the wood column. On one end of this cut a screw thread and fix a brass elbow to it; cut a second piece of pipe long enough to project about 2 inches beyond the base when one end is at the centre of it, cut a screw thread on one end of this, and screw it into the bend of the elbow, when the piece of piping will be like the letter L. At the top of the longer limb of the L cut on the outside a thread about $\frac{3}{4}$ inch long, and on this, when the pipe is in the column, screw a small brass cap. This cap should be large enough to make a neat covering to the wood end of the column, and should be screwed up tightly against the woodwork, so that the brass pipe is fixed firmly in position by it. Care should be taken that the shorter length of pipe in the base is quite clear of the surface on which the lamp stands—in fact, there should be a space of a $\frac{1}{4}$ inch between it and the surface of the table, so that when the flexible pipe is fitted on the lamp may stand firm. The burner and triangular carrier for the globe may now be fitted either directly into the end of the brass pipe by means of a screw thread, or by means of a small brass diminished socket as shown in the diagram; and this latter plan is much neater. The burner which I used carries its triangle on itself; it is stamped *J. R. and Co.*, is very cheap, and gives a beautiful steady light. The globe should be of opaque glass (not ground glass), and the opening at each end the same size.

If the amateur has not a set of taps and dies for brass, a gasfitter will fit up his lamp for a very small sum. The wire carrier for the shade, shown in Figs. 4 and 5 in plan and section, can be made by any one who can use a blowpipe, or it can be purchased for 6d. It consists of two $\frac{1}{8}$ inch wire circles, 5 and 14 inches in diameter respectively, connected together by four straight wires, each 5 inches long. Four clips of thin tinned iron, each 1 inch long and $\frac{1}{4}$ inch broad, are soldered to the upper and smaller ring, and these are turned in on to the upper edge of the globe to hold the carrier steady. A large green cardboard shade completes the whole. A length of rubber tubing will be required, and a nozzle gas cock on the wall gas bracket or chandelier. All the connections should, before the final screwing up, be touched with white lead to make the joints perfect. When the lamp is fitted up complete, a piece of stout baize should be glued on to the base to prevent scratches to furniture, and the woodwork brought to a dark colour and French polished.

Figs. 1 and 5 are quarter-size; Figs. 2 and 3 are half-size; Fig. 4 is not to scale; Fig. 6 is full-size. With regard to Fig. 2, it may be objected that in section the wood screw would not appear as drawn. This was drawn purposely to show the arrangement of the parts with greater clearness. For a like reason

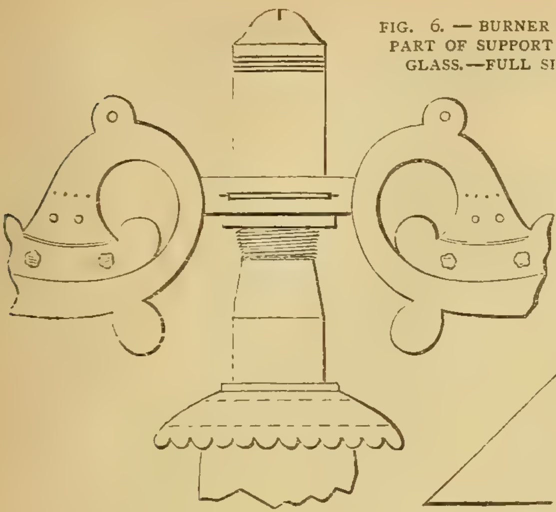


FIG. 6. — BURNER AND PART OF SUPPORT FOR GLASS.—FULL SIZE.

the brass elbow is left out, but is seen in Fig. 3.

I have said that the globe should be of opaque glass, but as the word "opaque" may lead to misapprehension, I had better say that I refer to a kind of glass now much in use for globes and shades of lamps, which is usually known as "opal" glass, and which, when viewed without any light in its interior, has an appearance more like porcelain than glass, and which to a great extent conveys the idea of opacity to the beholder. These "opal" globes and shades are made in delicate tints of pink and green, as well as in white, and, when lighted up from within, have a pleasing and agreeable effect. In this case, however, the shade that covers the globe is green externally, and thus renders the use of a tinted globe unnecessary, unless preferred by the user. The plan followed in making this lamp may be easily adapted for constructing a standard lamp to surmount a newel at the foot of any staircase.

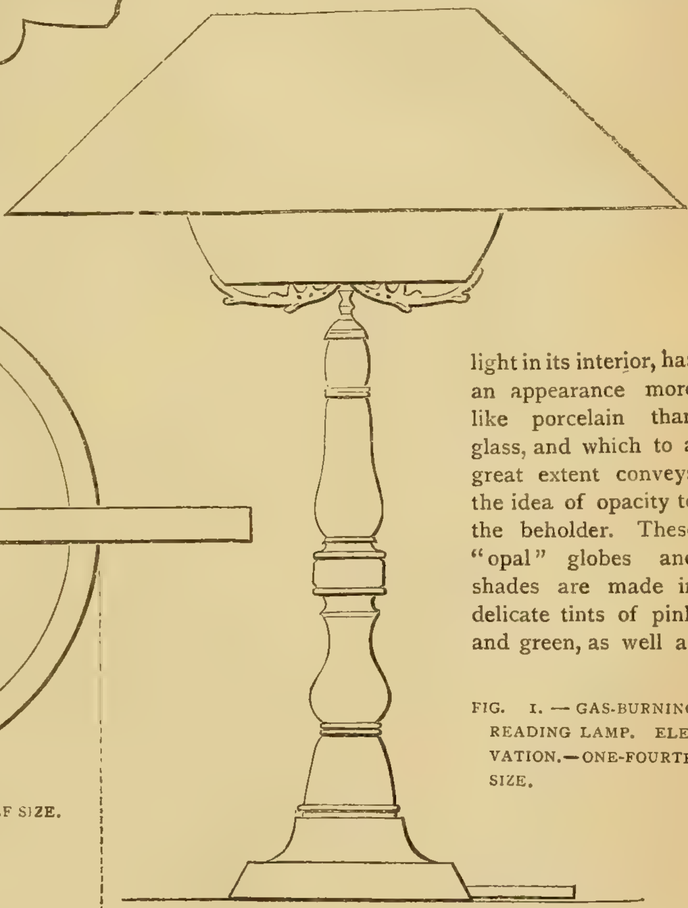


FIG. I. — GAS-BURNING READING LAMP. ELEVATION.—ONE-FOURTH SIZE.

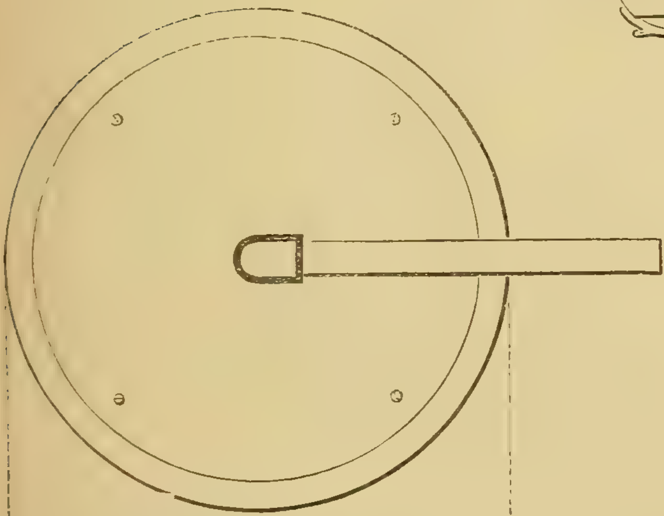


FIG. 3.—BASE OF LAMP IN PLAN.—HALF SIZE.

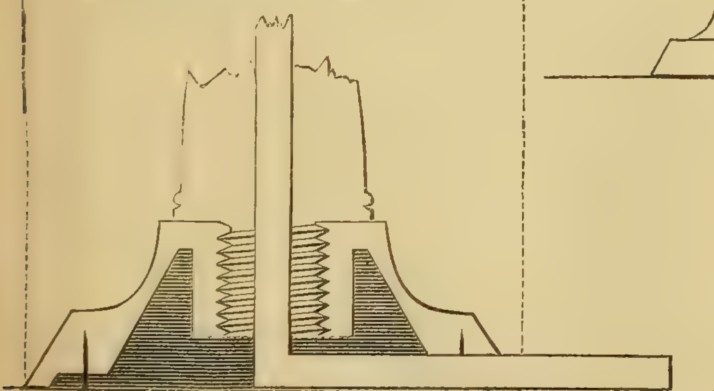


FIG. 2.—BASE OF LAMP IN SECTION, SHOWING GAS PIPE.—HALF SIZE.

HOW I FURNISHED MY SNUGGERY.

Being Part III. of "My Furniture, and How I Made It."
By MARK MALLETT.

IV.—MY PEDESTALS AND LOUNGING CHAIR.

AMONG the matters with which I wished to decorate my Snuggery were a pair of busts, and I proposed that one should stand on each side of my bookshelves. I might have bought scagliola pedestals for them, but these would have cost money, and I was moreover of opinion that with my home-made furniture, pedestals of my own making would be more in keeping. Fig. 32 is an elevation of one of those which I contrived.

In placing a bust, it is an important point to have the sculptured face much on the same level as that of the spectator, though, to the disadvantage of these works of art, this consideration is too frequently ignored. I, however, bore the above rule in mind,i and found that about 3 feet 2 inches would be the proper height for my pedestals.

From ¾ inch pine wood, 11 inches wide, I cut four lengths, 3 feet 1½ inches long. Two of these, to form the front and back, were the exact width I required; from each of the other two, which were to form the sides, I cut a strip 1½ inches wide. These four pieces when screwed together, made the carcase of my pedestal exactly four-square, as seen in Fig 35. For a top I fitted upon these an 11 inch square of ½ inch board, and screwed it down to them. To hide the junction of top and sides, and to give a finish to this part of the structure, I screwed round the top the moulding which appears on a larger scale in Fig. 33. This is mitred at the angles. It is made from the strip sawn from the sides worked into the shape shown. As to the ornament, which is intended to have something of the effect of the classical "egg and tongue" moulding, it is too simple a thing to be called carving, and to cut it demands none of the carver's skill. It is mere gouge-work. Each repeat consists of four nicks cut with the gouge, two with a smaller and two with a larger tool. For my part I can cut it in the wood much more quickly than I can draw it on paper.

As a base, I cut four pieces of ½ inch board, 1 foot long by 9 inches wide, and fixed them round the bottom. They are mitred at the angles. The top edge I rounded off, and ornamented it (as seen on the larger scale in Fig. 34), with a little more gouge-work, even more simply than that above. Fig. 35 is a section through the base.

Round-headed screws are used in this wherever they show. When the ease and simplicity of its construction are borne in mind, I think I was justified in considering my pedestal as a success. Of the four diagrams which illustrate it, Figs. 32 and 35 are on the 1 inch scale, whilst Figs. 33 and 34 are on the 3 inch, that is, are one-quarter of the actual size.

MY LOUNGING CHAIR.—My first attempt at making a chair for my Snuggery resulted in the seat of which a side elevation is given in Fig. 36. I call it a Lounging Chair. My chief aim was to make something that should be comfortable, though of course I wished it to be in character with the furniture around it. The chair before us is not absolutely a thing of beauty, and I do not present it to the reader as such; but I find, nevertheless, that it looks very well in its place, and there is nothing about it offensive to good taste.

I may also claim for it the merits of being strong, simple, and quickly made. I constructed it entirely of ¾ inch board. Its most important piece, that which forms the front leg and chair-back, and which is marked A, in Fig. 36, must be admitted to cut into what would appear an undue quantity of stuff. This s, however, a necessary consequence of its eccentric shape. It will be found to require a board 9 inches wide and 4 feet long. The pieces cut off need not, however, be wasted, but if sawn out carefully will serve for the minor parts of this or other articles.

The elevation, Fig. 36, is drawn to a scale of 1 inch to 1 foot, and shows the outline of both side-pieces so distinctly, that separate working drawings of them are not needed. The longer side-piece, already mentioned, passes behind the shorter one, but its position and figure are sufficiently indicated by the dotted lines. The shorter side-piece, marked B, which forms the hind leg and seat, is somewhat less wasteful of material as it takes a 7 inch board only, and a length of 2 feet 10 inches. In the elevation will also be seen how the hinder edge of the back, the under edge of the seat, and the legs, are finished off with a chamfer, and with just so much of the most simple kind of ornament as will bring the chair into keeping with the other articles of furniture in the Snuggery. The edges which are not chamfered—those which will come in contact with the covering of the chair, and possibly with the person who sits in it—are smoothly rounded off. The great width of these two side-pieces at the point where they cross each other, may perhaps appear excessive, but they are left thus for a sufficient reason. This width is intended to give ample space for screwing the two pieces firmly together, so firmly as to make them to all intents and purposes one. For it is upon this joint that the strain will be chiefly thrown. In Fig. 36 they are shown as fastened by five round-headed screws, driven from the outside, but in my own chair I supplemented these with three or four others, driven from the inside. This joint cannot be made too strong and rigid, for, when the chair is in use, every motion of the occupant will tend to

shake and loosen it, if it has but the slightest play.

Beyond its use in joining the two sides together, the bottom-board (the end of which shows at E, Fig. 36) also tends to strengthen this joint, as it is screwed into the edges of both pieces on both sides. This will be seen in Fig. 37, which shows the bottom-board from below. This board is 21 inches long and 5 inches wide. The front-spar, the end of which appears at D, Fig. 36, is of the same length as the above board (21 inches), and it is 2 inches wide. All its edges are well rounded off. Its ends are strongly screwed with flat headed screws to the pieces beneath them, into which they are let as shown. The top-spar, the end of which appears at C, Fig. 36, is in all respects similar to the front-spar, except that it is not so long by 1½ inches. It is fixed in the same manner.

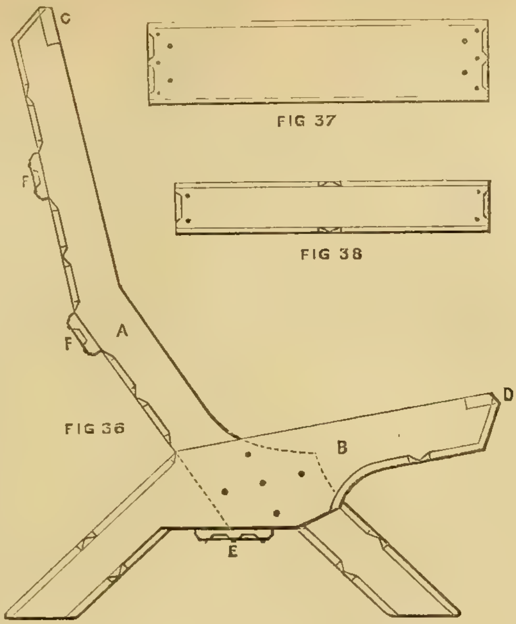


FIG. 36.—LOUNGING CHAIR—SIDE ELEVATION. FIG. 37.—BOTTOM BOARD. FIG. 38. — BACK SPAR. SCALE, 1 INCH TO 1 FOOT.

The two back-spars, the ends of which are marked F, F, in Fig. 36, are the same length as the top-spar (19½ inches) but are 3 inches wide. A view of one of these from behind is given in Fig. 38. Their backs are chamfered off as shown; and their front edges, except towards the ends where they come in contact with the side-pieces, are rounded off. Each end of these spars is fixed to the edge of the side-piece, by a couple of round-headed screws. In this chair the seat and back are formed of a single piece of carpet. I used Brussels as being the kind of carpet most firmly woven and least liable to stretch. Care should be taken that the pattern and colour are in good taste and keeping with the surrounding furniture. About 1½ yards is the quantity required. To secure the ends the upper one is tacked to the lower edge of the top-spar, brought round its back, and down over its top; whilst the lower end is in the same way brought over the front of the front spar, carried under it, and tacked to its back edge.

Upon the sides, the edges of the carpet are turned down over the front edges of the side-pieces (which are rounded off) and are tacked to the sides. In covering my own chair I finished off my work by running a strip of bordering over the tacks and fixing it with brass studs, but I did not carry this either along the front or the top. It will be observed that to prevent any woodwork from coming in contact with the person, the bottom-board and back-spar are kept as far away as possible, from the carpet. For most persons the top-spar will be found to be at the right height to form a comfortable rest for the head. This spar rises 38 in. above the floor; the seat is 14 in. high at its front, and slopes back to 11 inches.

(To be continued.)

FIG. 33.

FIG. 35.

FIG. 34.

FIG. 32.

FIG. 32.—PEDESTAL FOR BUST—ELEVATION. FIG. 33.—UPPER MOULDING. FIG. 34.—LOWER MOULDING. FIG. 35.—SECTION OF BASE.

AN OVERMANTEL FOR AMATEURS.

HOW TO MAKE IT AND FINISH IT.

By DAVID ADAMSON.

I.—The Construction of the Overmantel—Working Drawings—Dimensions—Materials—Connection of Parts—Inner Framing for Glass—Mouldings—Cornice—Shelves—Columns and Knobs—Brackets—Silvered Plates.

(*For Figs.* 4—20, *see Folding Sheet issued with this Part.*)

A FEW years ago it was considered the "correct thing" for our mantelpieces, or rather the walls behind them, to be furnished with a large sheet of mirror protected by a gilt frame, more or less showy and pretentious. Now, under the influence of increasing knowledge in matters of household art, the chimney glass is giving way to the overmantel, a piece of furniture which when carefully made with a due regard to proportion, is not only an ornament in itself but one which serves to hold the numberless odds and ends of china, etc., which go far to decorate our rooms. With some, perhaps, the strongest argument in favour of overmantels may be summed up in one word—viz., Fashion; but be this as it may, while admitting that the chimney glass has much in its favour to recommend it, there can be no doubt that from an amateur mechanic's point of view the overmantel is preferable.

The gilt frame of the former could hardly be turned out by an amateur in a satisfactory manner; but there is no reason why, with care and some amount of skill, the overmantel should not be made equally as well by the amateur as by the professional handicraftsman. Of course, the latter would be able to do the work in less time, and the work would be divided among several, such as the frame maker, carver, turner, etc., each able to execute his own portion with the economy of time which comes by practice. Apart from this, a skilful amateur when shown how, might do work just as well made and finished.

To show the amateur how to do the work is the object of the present paper, and I think the drawings and description will help over difficulties of a technical kind. I do not, however, describe the tools to be used, nor if I may so call it the elementary work of cabinetmaking, for I imagine no one will be so ambitious, I had almost written conceited, as to think he can make the overmantel without some little experience in wood working. If there should be, let me advise him to make a few boxes, picture-frames, and such like first, otherwise he may be quite sure that the result will not be good, for simple though the construction of an overmantel may be, neatness in every part is essential.

In Fig. 1 I have shown alternative designs with end elevations, Figs. 2 and 3, which sufficiently explain themselves. They and Fig. 4 are drawn to 1 inch scale, *i.e.*, 1 inch = 1 foot. All others are drawn full size. The first thing to be done is to make a full size working drawing of the overmantel, showing details of construction. It will not be necessary to draw more than one half, and for convenience in measuring it will be better if the drawing be made on thin wood, or if on paper hung flat against a wall.

The sort known as ceiling paper will be found very suitable for working drawings and much cheaper than ordinary drawing-paper. Very likely the sizes I give may not do for the space the overmantel is intended to occupy when finished; and as the question, "What size should it be?" is often asked by purchasers of overmantels, a few words about this may not be amiss. Briefly, I may say, "Suit your own views, as there is no hard and fast rule." Of course, don't take this to mean that the overmantel may be so small as to look paltry, nor yet so big as to project over the mantel-shelf. If for any reason it is desired to have the overmantel at the bottom larger than the mantel-shelf, then place on the shelf a mantel-board of the required size, which, if covered with cloth or other material and neatly bordered, will be ornamental as well as useful. Perhaps a safe guide for width is to make the outer uprights of the overmantel in a line with the outer edge of the fireplace jambs, and the height in proportion, not necessarily to the top of the room, indeed better not. Beyond this, it is impossible to define measurements.

By referring to Figs. 1 to 3, it will be seen that the overmantel I describe is 4 ft. 6 in. wide across uprights, or 5 ft. 4 in. wide including brackets at the bottom, 4 ft. 9 in. high to the top of cornice, and $7\frac{1}{2}$ inches deep from back to front, except at the bottom where it is a trifle more from the turned columns being *on*, instead of *in front of* the rails. Such an overmantel will look well either in American walnut, mahogany or oak. If it is intended to be ebonized it should not be made of the latter, but of one of the other woods. It will look well in rosewood, but this will be found more difficult to work, and on account of its comparative costliness veneer on mahogany can be used instead of solid stuff.

Mahogany stained to what is known as the Chippendale colour, is also effective and very similar in appearance to rosewood. Presuming that the overmantel is to be the size already named, two pieces each 4 ft. 10 in. long, and two pieces 4 ft. long, of $1\frac{1}{2}$ by $1\frac{1}{2}$ in. wood, will be required for the uprights A, Fig. 4.

It is immaterial whether mortising or dowelling is used in fixing the frame together, but as the mortise and tenon joint has my preference, I shall simply

name it in describing how the parts are to be fastened together. The uprights A may either be mortised into the bottom rail B, which is also $1\frac{1}{2}$ inch square, or the bottom rail in three parts may be mortised into them as the other cross rails are. If the former method, which I think the more workmanlike way of proceeding, be preferred, it will be well to have the bottom rail $9\frac{1}{2}$ inches longer, in order that $4\frac{3}{4}$ inches may project beyond the end rails on each side to support the brackets, Fig. 5.

The cross rails should be of $1\frac{1}{2}$ inch stuff. Those between the inner uprights are 26 inches and the others 11 inches in length, plus whatever may be the length of the tenon. The wide rails, C, Fig. 4, to which the shelves and cornice are to be attached, are shown $2\frac{3}{4}$ inches wide, for the others, D, Fig. 4, the spindle rails, 1 inch, will be enough. The lengths being ready, must be rabbeted as shown, Figs. 6 and 7. In Fig. 6, A shows section of wide rail, B section of long uprights. Of course, the short or outer uprights are rabbeted on one side only. In Fig. 7 the cross rails are shown in two different positions, that to the left, C, being flush in front with the upright, and the other, D, set back $\frac{1}{4}$ inch.

One or other should be used throughout the framing. It will not do to have some of the rails one way and some the other; with D there is less work and better appearance, but C allows the backing that protects the glass, or rather the silvering, to be nailed over the wood. Were this to be done with the set back rails, the overmantel would not go close against the wall, consequently the backing would have to be let *into* the rabbet over the glass.

The pros and cons having been stated the method must be a matter of personal choice. The rabbeting of the uprights should not appear above the bottom, D, rails, Fig. 4, but in practice it will be found easier to run the rabbet along the whole length and fill up after, than to stop the rabbet. In A, Fig. 6, the rails are shown with a bead on each edge.

This finishing will add much to the appearance of the overmantel without greatly increasing the labour. The uprights may also be embellished by beading, for which I give several suggestions in Fig. 7. They may all be worked with very simple scratches, and may either be carried the whole length of the uprights, or, what will look much better, stopped short an inch or so from the top and bottom, as well as from the shelves. I have indicated on the left hand upright of Fig. 4 the approximate places of stops.

It will be found difficult if not impossible to finish the stops off cleanly, with the scratch tool, so the finishing will have to be done by carving, of which a very elementary knowledge will suffice. Before fixing the parts so far described of the frame together, the spindles, Fig. 8, may be fixed between their rails. If preferred, these may however be left till later on, in which case the uppermost rails must not be tenoned into the uprights but fixed with screws, sunk and slanting from the back or top. So far as the frame is concerned, many overmantels are considered finished at this stage and the glass let into the uprights and cross rails direct. This plan has the advantage of showing a larger surface of glass, and if it is preferred all that has to be done is to fix the shelves, etc.; but as many will no doubt wish a heavier and more finished looking overmantel, I give a description of one with inner framing to hold the glass.

This inner framing as shown in section full-size, B, Fig. 6, is 1 in. thick by $1\frac{5}{8}$ in. wide, including the moulding. This moulding, instead of being run out of the solid framing, B, may be simply glued to it after the framing has been formed. For moderate sized plates, this method is practically as good as the other, and the work is less. These small frames are mortised or dovetail jointed, and may be a trifle smaller than the rabbet sizes of the upright and cross rails, as it is not necessary that they fit tightly. They can be blocked or bradded in. I feel this remark may to some rather savour of "scamped work," as indicating that it is not necessary to be so careful with parts that are not seen. It will be noticed, though, that I do not advocate unseen work being *badly constructed*; on the contrary, I would impress the necessity of all *constructive* details being honestly and soundly made, but finish on unseen parts is altogether another thing. Take all pains and care with finish of visible parts *and construction.* This digression may be regarded as superfluous, but I have been induced to make these remarks from having noticed the work amateurs frequently bestow, where it is not wanted, to the detriment of those parts where more would have been an advantage, and I therefore trust I shall be excused.

The inner framing for all the glass may be made in the way described, but the appearance of the overmantel will be greatly enhanced by a wider framing and more elaborate moulding for the centre plate.

A suitable moulding is shown on Fig. 9. It may either be attached to the framing, by glueing it on flat, or a rabbet, as indicated at E, may be made into which the framing fits. Another plan is to cut a rabbet in the framing, and sink the moulding into it. Of these three methods this is the strongest, and should be adopted whenever the centre plate is very large, though for the size of the plate shown by the drawing, any of them are strong enough especially if a few small screws are used as well as glue. As the moulding should project over the edge of the frame, no rabbet will be required in this other than that which is formed by the moulding.

The cornice or moulding on the top rail may next be fastened. Fig. 10 is the section of that on the right hand of Fig. 1. It should be mitred at the ends and the return be flush with upright at the back, as will be seen in Fig. 3. Fig. 11 shows that for the left hand of Fig. 1, F, being the moulding itself, and C a silp out of which the carved ornamentation is to be worked.

In Fig. 12, I give a suggestion for this, and no doubt it will occur to most, that this strip can be carved more readily before it is fixed to the frame than after. It will be observed that the end of the moulding on the left is not returned but is stopped at the upright rail, to which a finish should be given by a block similar to Fig. 13 (a side view). Fig. 14 shows a suitable terminal for the shorter uprights, which can easily be cut to the desired shape. These mouldings should all be screwed as well as glued to the frame. Fig. 15 shows the moulding, H, to be attached to the bottom rail of the frame; I, the projecting rail, on which the turned column rests; J, being the square block below the turning.

Before cutting and fitting I, it will be as well to attend to the shelves, which may be ¾ inch thick, the top edges being moulded the same shape as moulding in B, Fig. 6, or having a bead on each edge as A. The shelves are simply screwed to the cross rails, C, Fig. 4, pieces being cut out of the corners to receive the uprights if the rails have been set back as D, Fig. 7. Pieces must also be cut out of the front corners of the shelves, for the square blocks of the turned columns to fit into. The shelves may be fitted to the columns in the way I have indicated as being the easiest, without sacrificing appearance or sound work.

Screws, well sunk are run through the squares into the shelves, the holes being afterwards covered with small turned pateras, Fig. 16. If rich appearance is wanted and skill permit, these may be enriched by carving, for which I give several ideas in L. A little glue will keep the pateras in their places, and if ever it should be necessary to take the overmantel to pieces for convenience in packing, they can readily be removed and shelves, etc., unscrewed. The overmantel will then go into a very shallow case or crate.

Fig. 17 are details for turning a column, from which the various lengths of turned work can be adapted, space not permitting all to be shown. Underneath the shelves the bracket or stay, Fig. 18, may be used. If not under all, it should at least be under those at the top of the side, Fig. 2, as it fills up the ugly long square block necessitated by the spindle-rail above middle shelf. The brackets may be fixed either by simply using a few triangular blocks, glued behind them, or better and more neatly by countersinking them into the squares of the columns.

Possibly, some amateurs who would like to do their own turning, may be deterred by the length of the columns being too great for their lathes. For the benefit of these, I may state that the columns may be turned in short lengths, and afterwards joined by a dowel pin or double ended screw, care being taken that the pieces are joined straight and the joints being between two beads or elsewhere so that they may not be conspicuous.

The turned knobs require no special remark, the mode of fixing them being clear, Fig. 19. I may remark that if the corners of the squares of columns are cut as M, Fig. 19, the appearance of the job will be much improved, or even if slightly rounded instead of being left sharp. The columns being in position, the length of the foot rails on which they rest can be accurately determined.

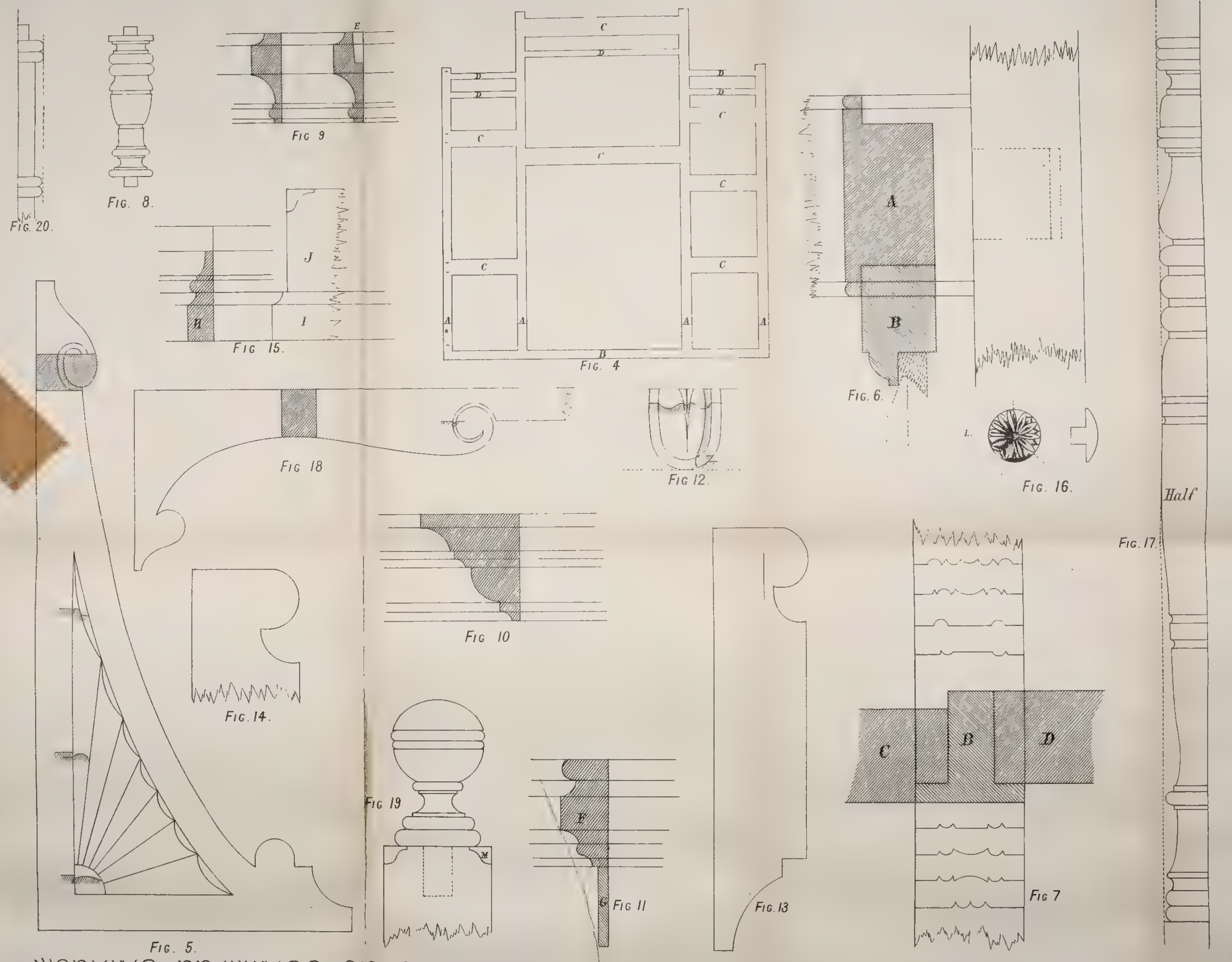
These rails, I, Fig. 15, should be neatly mitred into the moulding, H, and fixed with a screw from behind. A screw or wood-pin should also be run through I into J, from the bottom.

In Fig. 2 I show another mode of supporting the bottom shelf. The bracket is dowelled into the shelf above it, and screwed to the frame and foot-rail from behind and beneath. The turning for the short column is as shown in part, Fig. 20. This column may be fixed by cutting into the part of the bracket it is attached to, and afterwards filling up. If this is neatly done from behind, it will not be observable. With the exception of the brackets at ends of bottom rails, if these are to be used, and those at the top, the wood work may now be regarded as finished, though for those who wish the overmantel to be something of the nature of a cabinet to lock up particularly treasured ornaments, I have shown a small cupboard in Fig. 3. The framing of this is to be made in the same way as the inner framing of the back. It will be a great improvement to have the ends of these cupboards fitted with transparent, *i.e*, unsilvered glass panels, as well as the door which should have a bevelled edge plate. For the ends, the sort known as 21 oz. will do very well.

Silvered glass at the back of the cupboard, instead of a wooden panel will also improve the effect, and the inner framing may be omitted with advantage to allow the plate to be large. Instead of silvered glass at the back of the cupboard wood covered with plush, plain by preference, of a colour to show up the ornaments will look well.

For the door hinges, use "tipped butts." They give a finish not to be obtained with the ordinary butt hinges, even with hinge plates, which on a small door are apt to look obtrusive and vulgar.

I ought to have stated above that the transparent glass in the doors and ends of cupboards, should fit



WORKING DRAWINGS OF DETAILS OF ALTERNATIVE DESIGNS FOR OVERMANTEL.

Specially Drawn and Described for "AMATEUR WORK" ILLUSTRATED by DAVID B. ADAMSON.

For Figs. 1, 2 and 3.—Comprising Front and Side Elevations. *See Text.* Fig. 4.—Framing for Back. Scale 1 inch to 1 foot. Fig. 5.—Side Bracket. Figs 6 and 7.—Diagrams showing Rebating of Lengths for Frame. Fig. 8.—Spindle. Fig. 9.—Moulding for Centre Plate. Fig. 10.—Sub-section of Cornice on right of Fig. 1. Fig. 11.—Sub-section of Cornice on left of Fig. 1. Fig. 12. Suggestion for Carved Work on Strip G in Fig. 10. Fig. 13.—Side view of Block to stop end of Moulding. Fig. 14—Terminal suitable for shorter Uprights. Fig. 15—Moulding on Bottom Rail of Frame. Fig. 16. Turned Patera to cover Screw-holes. Fig. 17.—Details of Turned Column. Fig. 18.—Bracket on Stay below Shelves. Fig. 19.—Turned Knob for Top of Design on right of Fig. 1. Fig. 20.—Turning for Short Column at bottom of Fig. 2.

WARD, LOCK AND CO WARWICK HOUSE, SALISBURY SQUARE, LONDON, E.C.

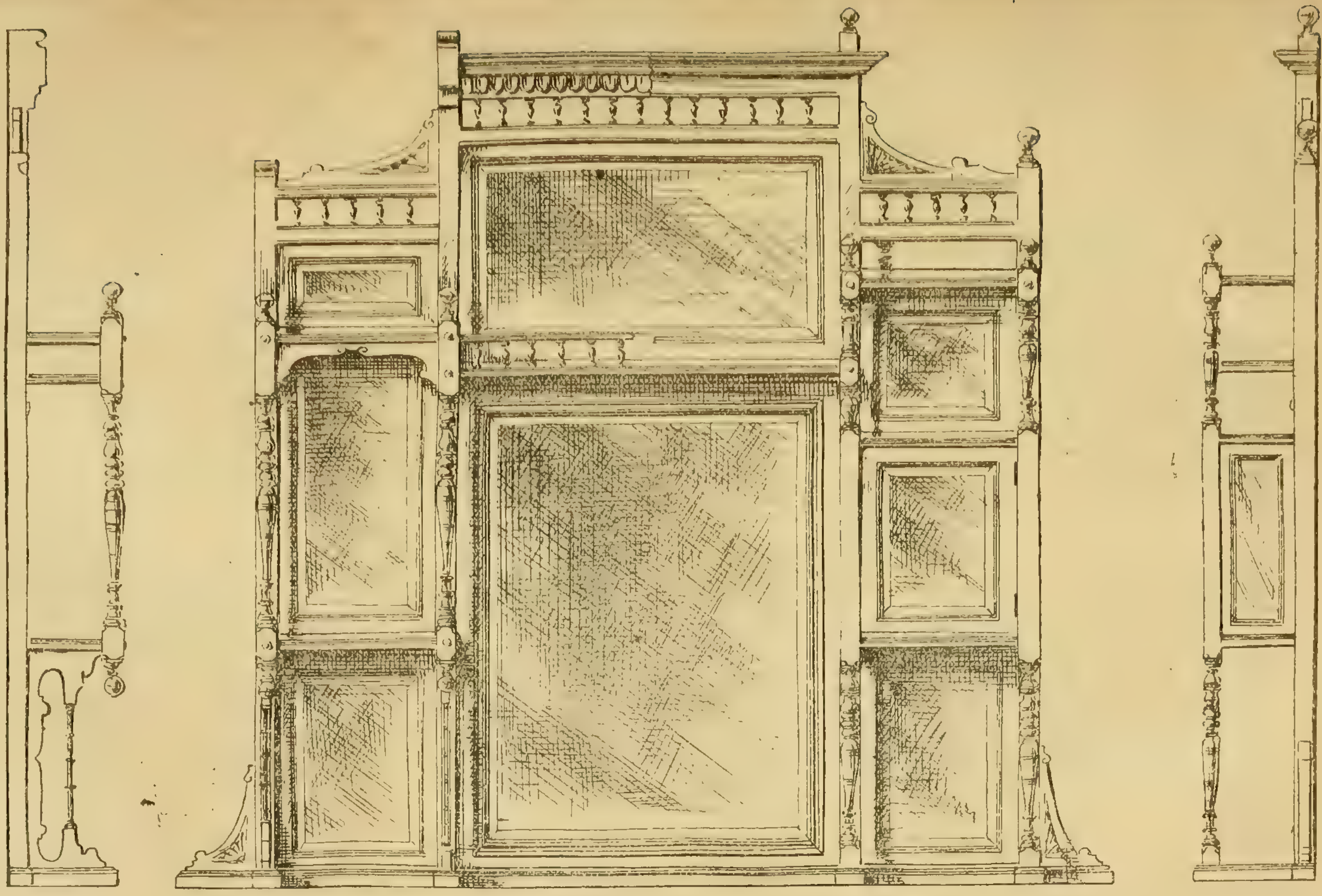


FIG. 2. FIG. 1. FIG. 3.

ALTERNATIVE DESIGNS FOR AN OVERMANTEL.

FIG. 1.—FRONT ELEVATION OF OVERMANTEL, EXHIBITING ON RIGHT AND LEFT OF CENTRAL LINE TWO DIFFERENT AND ALTERNATIVE MODES OF CONSTRUCTION.
FIG. 2.—SIDE ELEVATION OF CONSTRUCTION ON LEFT OF FIG. 1. FIG. 3.—SIDE ELEVATION OF CONSTRUCTION ON RIGHT OF FIG. 1.
SCALE, 1 INCH TO 1 FOOT.

closely into the rabbets as blocks would be unsightly, and be fastened in by strips of beading, neatly mitred at the corners. The beading can be fastened either with glue or small round headed brass screws. The frame being made, should next be polished.

It may be a useful hint to some to polish the turned parts while in the lathe, but beyond this from the admirable articles on polishing that have already appeared in this Magazine, it is not necessary for me to give instructions. Some however while wishing to make the overmantel, may not care to do the rather dirty work of polishing. Such people, unless in very out of the way districts, will be able to get a French polisher to do this for them, at from 12s. to 16s. No doubt it could be done for less, but it must not be forgotten that good polishing is always worth paying for. One or two shillings saved from the cost of polishing may cause what would otherwise have been a clean finished piece of furniture to look coarse and rough. After the polishing the glass may be fixed in, and as you will probably have to wait two or three weeks for glass, after the order for it is given, it will be as well to order it as soon as measurements can be taken.

In a former article, "A Small Cabinet," etc., p. 509, Vol. IV., I have given full instructions for measuring and fitting the plates, so I need not recapitulate, more than to say that the glass should be measured $\frac{3}{8}$ inch longer than sight size, and that it is fixed in by wood blocks, two or three inches long, glued to the framing and holding the glass firmly. After the plates are in do not raise the frame till the glue has set, and as an aid to the glue, a brad is often driven through the block into the frame. Section of glass and block are shown by dotted lines, Fig. 6.

For all plates except the centre in this overmantel, four or at most six blocks will be ample. The centre plate should however have about ten in all—two top and bottom each and three on each side. In order to protect the silvering, thin wooden backing should be fixed over the glass, either let into or fastened into the frame as already named. Let me give a word of caution about fixing the plates, and that is not to let any glue drop on to the silvering. If by accident, any should do so wipe it away at once, otherwise on hardening it will draw the silvering off the glass and leave an ugly flaw. It is, I suppose, by this time generally known that the old mercurial silvering has to a great extent been superseded by the "Patent Process with pure silver only," against which in some quarters there still exists a good deal of prejudice. So far as my experience goes, the objections to it, when properly done, are unfounded, and for many reasons it is to be preferred, especially by the Amateur. As both processes require special and rather costly plant, the work is not suitable for the amateur workshop. I have noticed that amateurs requiring bevelled glass are often in doubt where to buy it, so for their benefit, I may state that any good cabinetmaker will supply it, at least in the larger towns, but it is not kept ready bevelled and silvered in stock.

The price varies considerably in different districts, owing to the fact that there are bevellers and silverers in comparatively only a few of the larger trade centres, and, consequently, the cost of carriage must be added to the prime cost of the material. Another cause of variety in price is difference in quality of glass, silvering and bevelling. As I suppose, useful information of any sort, apropos of the subject in hand, is admissible to the pages of AMATEUR WORK, I give as some guide to the cost of plates for the overmantel I have described, the following figures which I think will be of service; as already observed, they cannot be taken as absolute in all cases, but they will, to a certain extent, indicate what the amateur ought to be charged, and prevent excessive prices being paid. Mind, if you are charged more, do not therefore jump to the conclusion that you have paid too much, for a very trifling difference in the size of the plates may satisfactorily account for a very wide difference in cost, glass increasing enormously in price per foot in proportion to the size of the plate, and anything over the inch being reckoned as a full inch; for example, a plate measuring $8\frac{1}{8}$ by $8\frac{1}{8}$ would be reckoned as 9 by 9 inches. This is the general if not the universal rule. Cost of plates are calculated by the superficial measurement. Cost of bevelling by the foot run and width of bevel.

In the figures I give, I reckon for $\frac{3}{4}$ inch bevel, which is wide enough for ordinary purposes. Owing to the various widths that different makers may cut the rabbets in uprights, etc., I am unable to do more than give approximate measurements for glass

Left hand design, Fig. 2. With inner framing.

Centre plate	2ft. 4in.	by 2ft.	= 4ft. 8in.	super.	£2 11s. 10d.
Top . .	2ft.	by 1ft. 1in.	= 2ft. 2in.	,,	
2 sides .	9in.	by 1ft. 4in.	= 2ft.		
2 sides .	9in.	by 4ft.	= 6in.	,,	
2 sides .	9in.	by 12in.	= 1ft. 6in.	,,	

The same without inner framing would be about £3 9s. 2d. In conclusion, it will of course be understood that anyone wishing to make an overmantel to match any given piece of furniture, say a cabinet or a sideboard, has only to alter his details accordingly, so that I hope this lesson on an overmantel will be useful, not only as giving details for one, but the mode of construction for any that it may be desired to have. By the way, the overmantel may be fixed to the wall by small brass plates, known in the cabinet-trade as "glass plates." They may be had from almost any cabinet ironmonger's or cabinet-maker's.

I may wind up this paper by saying that I do not desire in any way to make use of AMATEUR WORK as an advertising medium for pushing business; my contributions to it being written and drawn from an amateur standpoint. It is, therefore, not without some hesitation that I offer to supply any *amateur* with the necessary glass at the rates on which the above prices are calculated, with the addition of any carriage there may be, either from London or from where I write, if he cannot get it satisfactorily where he lives. Communication with me may be obtained through the Editor, who will address and forward any *stamped* letters bearing my name.

(*To be continued.*)

BOOTS AND SHOES:

CUTTING AND FITTING.

By A. MURRAY.

IN laying this paper before my readers, I should like in the first place to add my testimony to that of many others, as to the value of this book. I have been glad to have it by me, and have been helped by it many times. And I am thankful that there are such books to assist not only young men to spend their leisure time profitably, but also men who have their families around them, enabling them to do for themselves many things which, without such aids as these papers afford, they could not do. I also think the best way to show our appreciation is by recommending the book to our friends, and in this way help to increase its circulation. And now to begin our work.

In these days of ready-made boots and shoes, there are many, I have no doubt, who will read this who have never had their feet measured by a shoemaker, therefore it will be necessary to commence at the beginning. First of all, we must decide what sort of boot we are going to commence with. We had better take an elastic boot first, as they are so much worn, and most of my readers would prefer practising on their own. The first things we want are a size-stick and an ordinary tailor's measuring tape; the former can be bought at any grindery shop for one shilling, and the latter at any draper's shop for one penny. Take the length of your foot with the stick by moving up the sliding piece against the toe, whilst the other end should be against the heel. Mark the size on paper, then take the tape and measure around the joints, then the instep, afterwards the heel, and then the top of the leg, which for an elastic boot would be in the small part of the leg, just above the ankle, marking down the size of each part as you take it. Now we have the measure complete; the next thing are the lasts, which cost about one shilling and sixpence per pair. They must be two sizes larger than the foot. This is always allowed, and sometimes more if the foot is very wide and a narrow toe is wanted, and $\frac{3}{8}$ inch or $\frac{1}{2}$ inch smaller every other way. I will just give a hint here which may not be out of place to those who are going to buy. Always get the best shape you can. Many of the English-made lasts are flat waisted, big on the inside joint instead of the outside, and are stuck out at the back of the heel, being altogether of a bad shape. French lasts are the best, as a rule, and turn out a much better shaped boot; and though they cost a few pence more, they pay best in the end by the pleasure they give when working on them. The best English lasts I have lately seen have been Hobey's and Hutton's. And now having got our lasts, the next thing is to fit them up. Take some old pieces of leather, upper or insole, which are no use for anything else, and cut them to shape to lay nicely on the top of the last, wide at the joints, and narrow at the instep. If they will not lay easy, wet them, and lay them on just where they are wanted, so as to bring the last up to $\frac{1}{4}$ inch under the size of the foot at the joints and instep, and the heel will then be right. I may say here, if the foot is very fleshy $\frac{3}{8}$ inch can very well be allowed, as flesh will go where bones cannot. Nail your fittings to the block, only so as to be able to draw it out of the boot easily. Some readers may want to know why they cannot buy lasts the proper size without patching them up in this way, but if they had to draw the last out of a well-lasted boot, made without any fitting, they would know the use of this patching. And now for our pattern.

Take a piece of stiff paper, and cut out the pattern in one piece for an elastic boot about seven inches high, and allowing the $\frac{1}{4}$ inch under the measure at the top of leg and heel. At the instep and joints it must be about two inches smaller, so as to allow for the width of the bottom of the last. But if we take the last fitted up, and draw a pencil mark straight down the centre of the front, and let our pattern just come to it, allowing about half an inch over the bottom of the last for lasting, this will be right. So as to make this perfectly plain, we will suppose this is the measure of foot taken, viz., length, 5 inches; heel, $13\frac{1}{2}$ inches; instep, $10\frac{3}{8}$ inches; joints, $9\frac{1}{8}$ inches, and top of leg, $9\frac{3}{8}$ inches. Our lasts must be 7; joints, $8\frac{7}{8}$ inches; instep, $10\frac{1}{8}$ inches; and the pattern 7 inches high, $12\frac{1}{4}$ inches long, and $4\frac{9}{16}$ inches across the top of the leg. It must be noticed that the pattern is only one-half, but it is customary to double the measuring tape and measure as though it went around for the measures, so in that case this would be $9\frac{1}{8}$ inches, heel, $13\frac{1}{4}$ inches; then measuring by the last, the instep

will be 9 inches and the joints 6 inches. If this is properly done we shall have a pattern the shape of Fig. 1 in the illustration, which will help us by showing the shape, and where measurements are to be taken.

Now, having our first pattern, the next thing is our small patterns. Cut another pattern by this one of the same shape and size, then cut a piece out of the leg of this second one, the shape of piece, A, which must be $2\frac{1}{8}$ inches wide at the top, and $4\frac{5}{8}$ inches deep in the centre for the elastic, narrowing gradually down and rounding at the bottom. Perhaps, if this was marked first with a pencil it might be cut better, then cut off the piece B, which is the back, as marked. This will be $1\frac{1}{8}$ inch wide at the top, $3\frac{1}{2}$ inches at the bottom, $3\frac{5}{8}$ inches at the bottom of the elastic, and $2\frac{1}{4}$ inches deep where it is cut off. The next piece is C, which will be the vamp. This is $4\frac{1}{2}$ inches up the front from the toe, and $2\frac{3}{4}$ inches deep at the side. The front, D, is then by itself. As yet we have only half a vamp, so take another piece of paper and double it, then lay the piece just cut off on it, with the front to the edge of the fold, and cut it by that so that when opened it will be the shape of Fig. 2. Now we have our patterns complete, and want our leather, lining, etc., for the uppers. The calf for the vamps and back is sold at about 4s. per lb. by the skin, or if cut at 6d. per ounce for the prime.

If any of our friends are going in for getting up boot tops it would be cheaper to get a skin, but do not get a very stout one, as they are none the better for being too heavy. The kid skins vary in price from 6s. to 12s. each according to size, but you may get half a skin or pieces as you like. Good twill boot lining costs from 6d. to 9d. a yard. Now take your calf skin, open it out, and lay your vamp patterns on it and cut them out, but be careful not to put in the loose rough offal round the outside. Let the toe of your vamp point towards the middle of the skin, and look at the skin well to see that you are not putting flaws in. The wings of the vamp can come nearer to the edge than the forepart, as they are not subject to the same amount of strain. Now take the backs, cut the first by the pattern, but allow $\frac{1}{4}$ of an inch larger up the back for seam, and $\frac{1}{2}$ an inch at the bottom of the elastic, as shown by the dotted lines on the small pattern figures. Then having cut one lay it face to face with the skin, and cut the next one by it, so that they will face, then cut another by each of these, as we want four of them. They need not necessarily be out of the prime part. Now take the kid and the small front pattern, and cut these the same as the others to face, allowing $\frac{1}{4}$ of an inch up the front for seam, and $\frac{1}{2}$ inch (or $\frac{5}{8}$) around the bottom. Let the kid be good or it will soon wear out; we shall want four of these as well. Now take the first large pattern and cut your lining by it, allowing $\frac{1}{2}$ an inch for seams back and front.

The next thing required is webbing, which costs one penny per yard, of which we want 21 inches to be cut into four pieces, each $5\frac{1}{4}$ inches long; then the elastic, 5 inches terry, which can be had at all prices from 1s. 3d. to 2s. per yard, but which is generally bought by the set of 10 or 11 inches. We shall want 11 inches for these, that at 1s. 8d. will do; but the best is the cheapest in the end. This must be cut into four equal pieces, putting the wide part of the first and third the same way, and the second and fourth the reverse way. Next cut two pieces of the thin offal from the calf skin $2\frac{1}{2}$ inches wide and 7 inches long. If it is stretchy pull it well out and let the width come the way it gives.

Now our cutting is finished, so we will now fit and close them. Take one of the back pieces, one of the kid fronts, one side of the lining and one piece of elastic, and after skiving the edge of the back piece, where the vamp will come over it, paste the sides of the back and front which come on the elastic for $\frac{1}{2}$ inch in. Take the pattern A, and lay it on the elastic, then bring your leather up to the edge of the paper and there stick fast, so that you will have the elastic showing just the size of the paper, and nearly $\frac{1}{2}$ inch on the back of the leather everywhere but at the top, where the leather will be about $\frac{3}{4}$ inch above the elastic. Cut these corners off on the round from the elastic up to the other corner, then take the lining and lay on the back, and cut out the place for the elastic, leaving $\frac{1}{2}$ inch all around to turn in under, and thus make the elastic to show nearly the same size back and front. While the paste is drying on this, do the other three sides in the same way, then stitch in the elastics with the machine, afterwards stitch the kid up the front, taking nearly $\frac{1}{4}$ inch holdfast; do the back seam the same way, then take the thin piece of leather and place it up the back on the lining, brown side showing. Place the loop of webbing in between the two pieces of leather and stitch it right through. Now place a piece of any coloured sheepskin, or the thin calf will do, across the front top on the inside $1\frac{1}{2}$ inch deep. Put in the loop and stitch, then do up the front seam of the lining, taking $\frac{1}{2}$ inch holdfast, then try it on the last for the length, and fit the vamp to it to the proper length. If the wings of the vamp should be a trifle long, cut them off to shape, paste on, and stitch through. If it is preferred, a row of holes may be punched in the vamp just around the front, about $\frac{3}{16}$ inch from the edge with a No. 1 punch, and a row of stitching put each side of them. When all is done hem down each side of the leather lining with needle and cotton. Now our first pair is finished.

Lace boots are cut in the same way, only there is a back golosh the same width as the wing of the vamp, and the upper part is cut all in one; so that in cutting the pattern, if the wing of the vamp is $2\frac{3}{4}$ inches deep, it must be carried straight on the same depth to the back, and that can be cut in one piece from the toe, so as to have none but the back seam in it, or it can be joined at the sides The piece of the pattern which is left when the golosh is cut off is generally cut in kid or Levant seal. There must be pieces of leather—coloured roan is generally used—up the sides under the eyelets (unless it is a water-tight tongue, in which case the tongue being stitched out to the edge, and about one inch in before it goes across the front, occupies the same place and answers the same purpose), and right across the top about one and a-half inch deep.

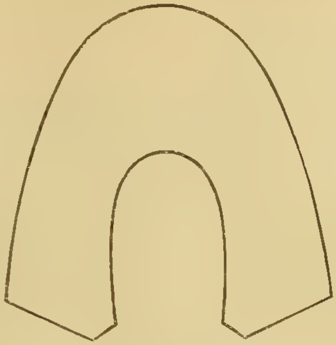


FIG. 2.—VAMP, OPENED OUT.

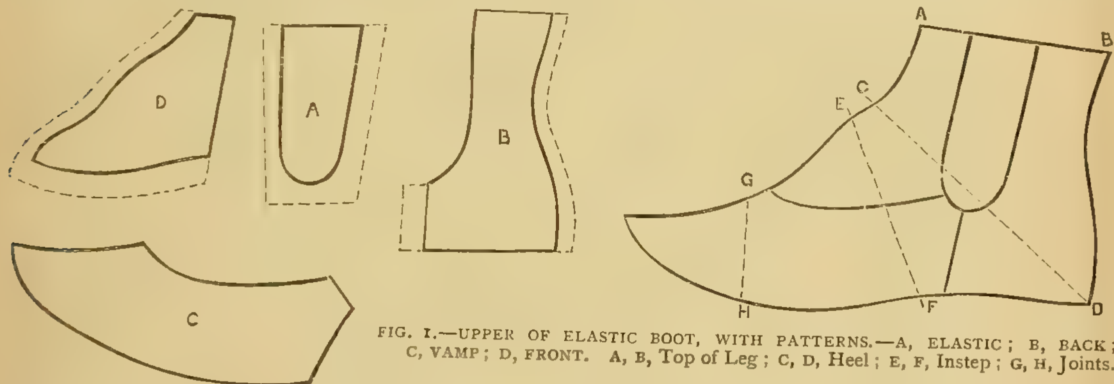


FIG. 1.—UPPER OF ELASTIC BOOT, WITH PATTERNS.—A, ELASTIC; B, BACK; C, VAMP; D, FRONT. A, B, Top of Leg; C, D, Heel; E, F, Instep; G, H, Joints.

The top is also sloped into a hollow the same as is done in women's boots, but all men's boots are the better for having a piece of leather in the inside of the back, as it saves the lining from wearing and hurting the heel. Eyelets and hooks are put in after the tops are finished.

The punch needed for making the holes for a man's boot would be about No. 6, that for women and children smaller, according to the size of the eyelet. The punch for putting in the eyelets cost 1s. 3d., and is used in the same way as the other punch.

Imitation button boots are cut in precisely the same way as these, and can have either a back golosh or a back similar to the first, which is a newer and a better style, the button piece being either an extra piece closed in with the seam and stitched around, or simply formed by rows of stitching on the upper.

Imitation lace is done in the same way by either stitching on a piece about $1\frac{5}{8}$ inch wide straight down the fronts, and putting the eyelets in that, but not to come through the lining, or putting a couple of rows of stitching in imitation of a facing.

Blocked fronts are cut the shape of Fig. 3: the pattern is cut double, being folded down the centre as marked. To cut a blocked front the size of the boot we commenced with, the pattern would have to be 14 inches along the fold in centre, $12\frac{1}{2}$ inches along the bottom, and $7\frac{1}{2}$ inches up the back. This pattern would have only the back seam; the calf or kid should be cut so that it would stretch across the foot. Short cuts must be made as shown, about three inches long, 1 inch in from the back at the top, and 2 inches at the bottom. This had better be cut in the pattern when doubled. Blocks for blocking on are sold at the grinder's ready made for about 1s. each.

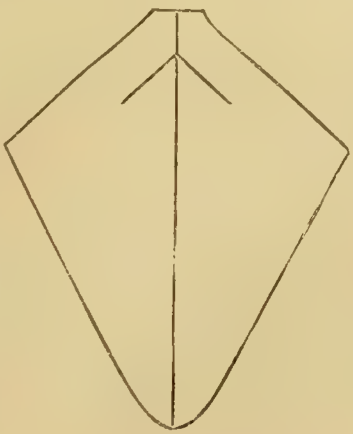


FIG. 3.—SHAPE OF BLOCKED FRONT.

Wet your leather well to soften it, then put it on the block and pull it well to the shape, tacking it around the edge to keep it down. When well blocked put it on one side to dry before taking it off, then cut the top of the back and front to shape, and cut the place for the elastic to proper shape.

A lady's lace boot is generally cut with a wing vamp and the quarter all in one piece. The

difference between a wing vamp and the front golosh already described is that the wings of the former are rounded off at the ends to the sole. Ladies' vamps are not cut as high as men's, especially as low vamps are now fashionable.

The pattern for a button boot is the same as a laced one, with the addition of the button piece. These are of two shapes, the straight and the scalloped.

We must deal first with the straight. Lay your quarter pattern on a piece of paper, and cut it to the pattern down the front, then cut off this piece $2\frac{1}{2}$ inches wide. Cut about a quarter of an inch off the side first shaped at either end, narrowing off towards the centre to nothing, leaving an inch not touched in the centre; then narrow it down on the outside, from the top gradually to about $1\frac{1}{2}$ inch in width at the bottom hole, which would be about $1\frac{3}{4}$ inch from the bottom, and take a piece $1\frac{1}{4}$ inch long on a sudden curve from the bottom, leaving it $\frac{5}{8}$ inch at the bottom.

For a scalloped one, cut the pattern in the same way on the inside, and scallop the outside, making each one smaller as they go down. A kid lining is always put to the button piece, and $\frac{1}{4}$ inch wider must be allowed all down, so as to hem over the seam of the outside. A narrow strip of leather should be put between the upper and lining, under the buttons, to strengthen it. Of course, a golosh may also be put to ladies' boots, which would be the same as the men's.

We shall now proceed to shoes. First, an Oxford, which is a lace with about five holes. The back should be $3\frac{1}{2}$ inches deep at the seam; the instep will be according to the measure. From the instep to the back is a hollow curve, which makes it appear to be lower at the sides, though it is not so in reality. The vamp is a wing, and goes over the quarter. The Derby, or tie shoe, is rather different in cut as it has but three holes. The vamp is continued so as to form the tongue; and as the vamp goes under the quarter, it is the quarter we must get into shape. It is cut, in the first place, the same as the last, but rather more hollow at the sides, coming up with a more sudden rise to the toe. Then the front for the eyelets is rounded off at the bottom and front and brought to $2\frac{5}{8}$ inches where the eyelets go. This makes the front where it comes on the vamp slope down with a more sudden sweep to the bottom.

In cutting any of these patterns I should advise my friends to examine any boots or shoes of these styles, as this will help them to get a proper shape; and if they see a different pattern which they prefer, to take it by laying the paper on it and rubbing it well on the seams with the finger or heelball, always allowing for seams, especially where one part is laid over another a good half inch should always be allowed in such places.

Slippers are simply a golosh such as has been described, but a little deeper in the quarters. Long boots I have omitted, as they are so little worn; but if any reader should want a few hints in reference to them, I shall be pleased to answer all inquiries.

With the hope that these instructions may be found sufficiently plain to enable those who read them to accomplish the cutting and fitting in a manner well pleasing to themselves and friends, I now draw them to a close.

ELIZABETHAN FURNITURE:
WITH PRACTICAL HINTS ON ITS CONSTRUCTION.

By Rev. ALGERNON THOROLD, M.A.

V.—CONSTRUCTION OF SIDES OF CABINET.

THE lower part of the cabinet being so far complete and out of hand for a time, we may begin to think about the sides. Fig. 6 (page 360) shows one side. Fig. 15 (Folding Sheet with Chapter IV.) shows the side again with the pegs out, and the several parts slightly withdrawn from each other.

We now take one of the large pieces of panelling, Fig. 27, which formed the top or back of the bedstead, which we have by us, and mark upon it in chalk the outline, as shown by the dotted lines in this diagram. We shall then have a complete side set out. On reference, however, to Fig. 16, which shows the framework of the cabinet in skeleton, we see that the lower side rail, H H, is fixed below the front rail, B B, in consequence of which we shall probably find that we have not the full length as required between H H and D D, Fig. 27, D D being the rail which corresponds with the front rail, E E, Fig. 16. If on measuring up we find that this is the case, we have two plans open to us—we may either allow the lower rail H H, Fig. 27, and B B, Fig. 16, to run round level, or with such difference of line as the framing (Fig. 27) will permit, and so avoid any alterations, or we may carry our chalk lines as much further down the panelling as required, and as shown in double dotted lines in Fig. 27.

If we determine to have the lower rail below the long rail in the front, we must look round for some longer panels than we have before us in Fig. 27; but should none be available a second rail must be fixed as in A A, shown by double dotted lines in Fig. 27, and the old work kept as it is. A long narrow panel must also be inserted between A A and H H; but in case we are again thrown out by the length of the

required panel from O to O (Fig. 15), we must retain a part of the stile, C, and keep portions of the panels, M M, in their places also.

If we do not possess an extra rail like A A, suitable for our purpose, we must set to work and make one after the pattern already given in Fig. 24, only, of course, of the size required. It must be grooved to receive the panels, M M, and mortised in the centre to carry the tenon, which must also be cut at the end of the shortened stile, C.

When our chalk lines are in order we may carefully rip the long rails asunder as marked; but any rails or stiles that can be removed by knocking out the pegs should be so treated; tenons should never be cut into when it is possible to avoid it. Panels should also always be taken out to be altered, as it is very easy to forget that the sight-line is not the true one, owing to the grooving in the rails, and into which they sink. It will be advisable to get out both the sides at one time, and be very careful that you do *not* cut them to stand both the same way as in Fig. 28. They must when laid out flat, with the carved or moulded side upwards, lie together as in Fig. 29. To avoid such a mistake chalk the words "right" and "left" on each piece of panelling; and if you have sufficient floor room, lay them side by side and mark them out as in Fig. 27 before using a tool upon them.

We began our work upon the cabinet on the understanding that we had a certain amount of old oak for which neither we nor our friends had before conceived any use; and therefore it may appear somewhat needless to give details for work if the chief proportion of the framing and panels is altogether wanting. But since there is no limit to the energy of some amateur carpenters, and the desire to make something often leads them to turn out what could be purchased more cheaply and better made, and which are prosaic to a degree—chests of drawers, wash-stands, etc.—there will probably be little harm done in giving directions for the construction *de novo* of so uncommon a piece as an Elizabethan Cabinet. It has been supposed that we were obliged, after all, to make a new front, and as we have turned it out a good job we will go on supposing that we are once more thrown upon our own resources, with nothing but old planking and some panels.

Full measurements of the rails and stiles, which must now be made, are given in Fig. 15. The grooves in these rails and stiles must be ploughed before any mouldings are run on, to ensure that they shall follow each other in the angles.

The work to which we have thus set ourselves is, after all, but plain straightforward carpentering, and if moderate care is expended on the tenons and mortises there can be no reason for doubting that the result will be satisfactory, provided also that the lines and measurements laid down in these diagrams are strictly adhered to.

If, however, no recourse has been needful to old planking for the rails and stiles of the sides, but we have cut them out as before described from genuine panelling, we may at once take the first step towards putting the front and sides together.

The pegs at E E, Fig. 27, being knocked out, we pull away the rail from the rest of the side. After running the plane over the rough side where the rail was ripped in two, we proceed to mortise in A A, so that the rails, D D and A A, Figs. 27 and 20, shall run level with each other as in Fig. 16.

It may, however, happen that the side rail, A A, of the chest front may be of sufficient substance to render any such addition needless, in which case the long rail, M, Fig. 27, need not be cut at all, but simply unpegged, and the tenons of the cross rails, D D, H H, carried straight into the side rail, D D, of the front, Fig. 25. If the front of our cabinet has been formed, as supposed, from the front of a chest, mortises will already be cut at the back of the perpendicular side rails or legs, and which have been used previously for the chest sides. If, however, these perpendicular rails are less than $1\frac{1}{2}$ inch thick, they will not be of sufficient strength to carry the sides of a heavy cabinet, and we must, as already stated, fasten slips or fillets on the half-rails which form parts of the sides. This should be done by means of screws let in through the grooves, the two faces being brushed over with very hot glue before fastening up. Looking at these when fastened together, they will appear as Fig. 30. When these are firm and dry we may, having cut the perpendicular rails or legs to one and the right lengths, slip the side-rail tenons through the mortises to correspond and temporarily peg them together. We shall then see the front and sides of our cabinet standing up in due relation to each other.

It will not, however, be safe to allow this shell to stand long in such a condition, lest the joints should sustain any strains or splits, which may make the cabinet tottery for the rest of its existence; back rails must therefore be added as soon as possible. To do this we must prepare two strips of any hard wood—new stave oak will answer well—corresponding in length with the perpendicular long back rails. For thickness these strips should be within $\frac{1}{4}$ inch of the same thickness as the rails, but 2 inches in width. In the thickness of the wood cut three mortises as shown at A A, in Fig. 31; then screw and glue these strips on the inside, and flush with the inside of the long perpendicular side rails, as shown by the dotted lines in Fig. 32. The screws must enter from the outside,

and the countersinking must be deep enough to allow us to cover the screw-heads with thin pieces of oak.

This done, we must cut three more strips for the cross-rails, B, Fig. 31, of the same dimensions, excepting length as before. The cabinet must, of course, be of the same length back and front. The length of these three last strips must therefore be such as will, when tenons are cut at each end, and when placed in position, B B, Fig. 32, make the length of the back, from A to A, Fig. 33, equal to the length in front from X to X, Fig. 16. It is impossible to give the measurements of the cross-rails with exactness without knowing the thickness of the perpendicular side-rails, and as this will differ in different cases, the length of the cross back-rails must always be worked out to suit the special requirements. When finished and planed up, they may be placed in position and pegged temporarily together. Our cabinet will then appear, looking at it from the back, as in Fig. 33.

A reference to Fig. 16 will show that the upper central front of the cabinet is set considerably further back than the lower and upper fronts, and it is this arrangement which imparts character to the whole. Fig. 14 shows the construction of this part. It is a simple frame, the side-rails of which rest between the cross-rail, C C and D D, Fig. 16; while its long upper and lower rail, F F, fall and rise respectively below and above the rails, E E, G G, of Fig. 16.

At P, P, in A A, Fig. 14, tenons are cut, falling into corresponding mortises in D D and C C, Fig. 16, and through which pegs are eventually driven to keep the parts together. Old rails and stiles may, by preference, be used for all the parts required, any grooves and mortises which are unavailable being filled up as before described; but should our old pieces give out, we must once more fall back upon planking.

Between G G, G G, Fig. 14, doors will presently be hung; but as it will be better to make all our doors together, we may proceed with the sunken frame and panel at O, Fig. 16, and H, Fig. 14. Fig. 34 shows the construction of this frame, and which, owing to its unusual form, we must make for ourselves. It is larger every way, by $1\frac{1}{2}$ inch, than the opening at O, Fig. 16, to allow for a $\frac{1}{4}$ inch flange being cut all round, as shown at C, in Fig. 34. This flange is cut sufficiently in from the outside edge to enable us to push the frame tightly into O, Fig. 16. Four screws, one through each edge at the back, will then hold it firmly in place. A panel, which must be carved or inlaid, is then also screwed on at the back of the frame, thus completing it.

FIG. 32.—MODE OF ADDING STRIPS.

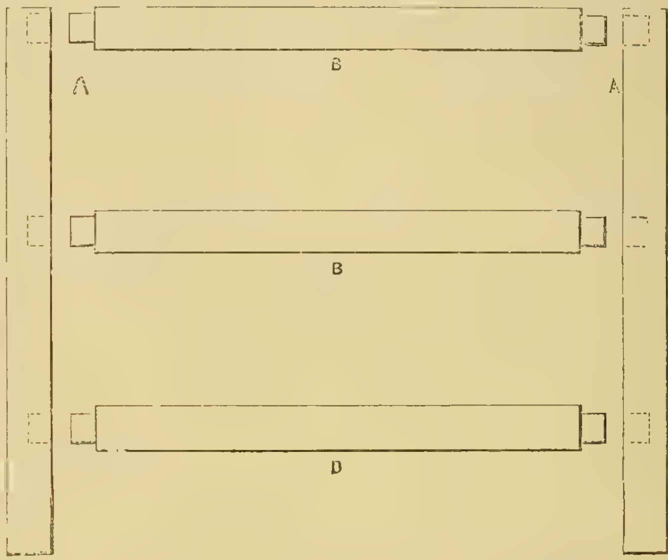


FIG. 31.—SIDE RAILS AND CROSS RAILS FOR STRENGTHENING FRAME.

FIG. 30.—RAIL WITH FILLET.

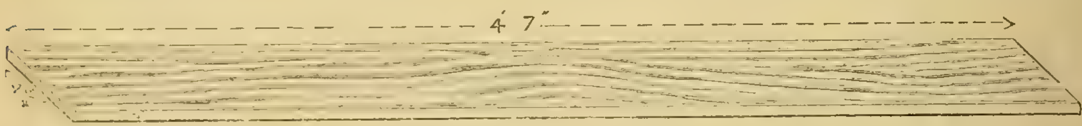


FIG. 35.—SHELF.

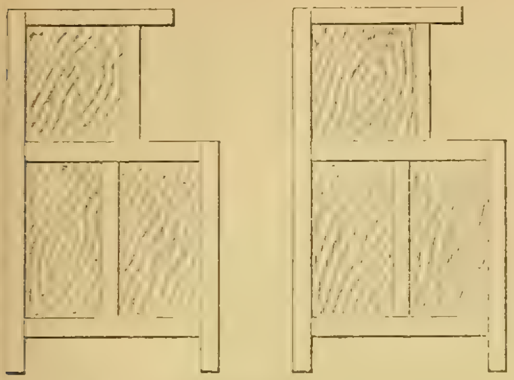


FIG. 28.—PANELS WRONGLY CUT, BOTH STANDING SAME WAY.

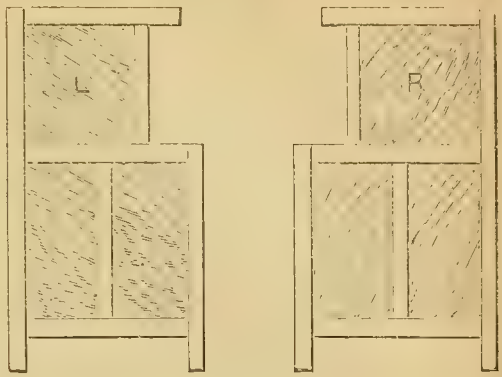


FIG. 29.—PANELS RIGHTLY CUT, STANDING IN OPPOSITE DIRECTIONS.

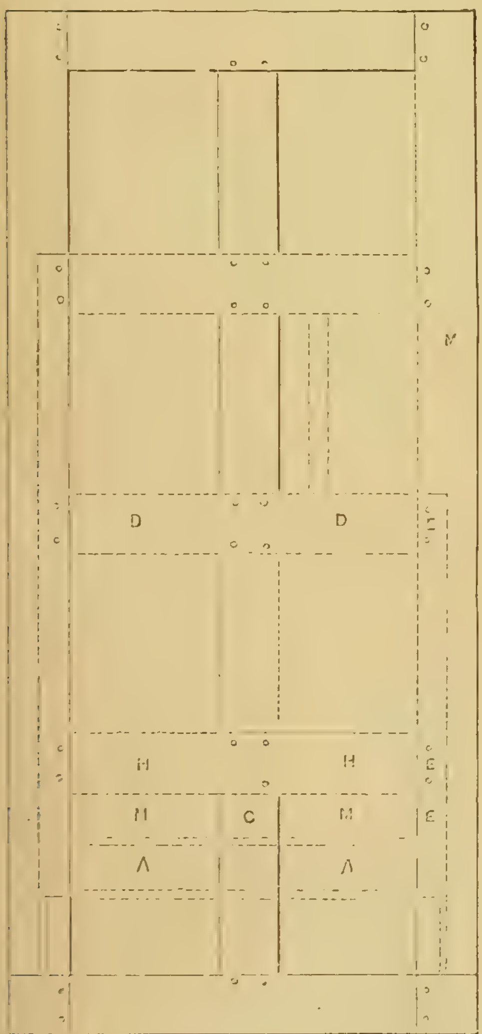


FIG. 27.—OAK PANELLING MARKED FOR SIDE.

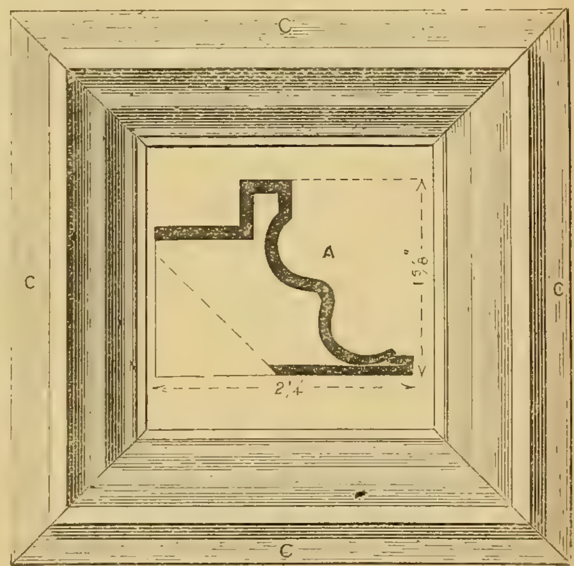


FIG. 34.—SUNKEN PANEL AND FRAME.—A, SECTION OF FRAME OF PANEL.

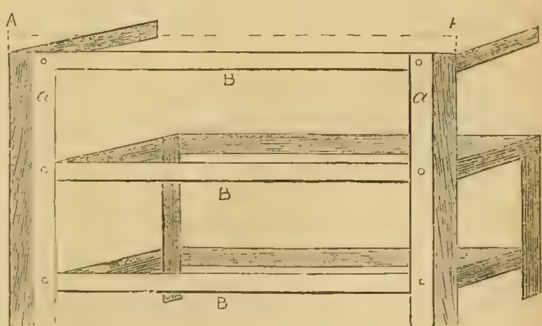


FIG. 33.—BACK VIEW OF SKELETON OF CABINET, PEGGED TOGETHER.

We need not confine ourselves to any particular moulding in making this frame, but its beauty is much enhanced by depth. This appearance of depth is obtained more by the inward slant of the frame than by its actual thickness, as shown in the section of the frame given at A, in Fig. 34, the measurements of which are full size, and can therefore be taken as a model.

For actual work it will be necessary to prepare this framing in one or two long lengths, running the flange and moulding straight through. Any attempt to make each piece separately will involve much extra labour, and we shall probably find that the mouldings will not mitre after all. The hollow mouldings will look best if left plain, but a small chain pattern carved along the flats will be a great addition. Upon the top of the lower front, see Fig. 1, and overhanging it by $\frac{1}{3}$ inch, a shelf, Fig. 35, is fixed. It runs back to the lower rail of the recessed centre, and fills in the gap which would otherwise exist. This shelf should be of $\frac{1}{2}$ inch stuff, its upper edge being bevelled along the front and round the two ends. There will be no difficulty in having one of the planks sawn through to meet our requirements.

(*To be continued.*)

PURE REPOUSSE WORK,

AND HOW TO DO IT.

By LANCELOT L HASLOPE,
Author of "Repoussé Work for Amateurs."

II.—CLASSIFICATION OF REPOUSSE WORK—CHASING—MATERIALS—BRASS—TRANSFERRING DESIGN TO BRASS—FIXING BRASS TO PITCH—CHASER'S BOWL—CEMENT—TOOLS FOR CHASING—MANIPULATION OF TOOLS.

PURE Repoussé Work may be divided into three distinct processes: 1. Chasing, or Tracing. 2. Raising. 3. Modelling. Chasing—that is, indenting the surface of the metal to be decorated with a well-defined outline—is naturally the first, and sometimes the only process used. Flat chasing, as it is called, when the work is not beaten up after the outline is cut, is most suitable for waiters, salvers, etc., where a raised surface would interfere with their usefulness. Work of great beauty may be produced by this method, particularly if the design is well chosen, and I would recommend that the amateur's attention be devoted to this alone, until considerable proficiency has been acquired, and really good work can be done. The outline should be clear, well defined, and perfect, before any thought should be given to beating it up. If there is any imperfection in the outline, any attempt at raising the design only increases the evil by making the defects more apparent; and the outline once cut, it is impossible to remedy anything that is wrong in it.

As on all accounts it is better to commence operations on brass, for the reasons I have given, I will now describe how it is to be prepared for working on.

Suitable brass may be obtained all ready for the worker's hand, but of course it is cheaper when procured as it leaves the rolls. Six, nine, and twelve inches are the widths I generally use; if I were to use one only, I think I should select nine inches as the most generally useful size, but of course my readers must choose for themselves. It can be bought in almost any reasonable length. Care should be taken that it be free from flaws, deep scratches, and other imperfections. Having procured the brass, the next thing is to cut it to a size suitable for the selected design; a pair of tinman's "snips" are required for this—these are small hand-shears about eleven inches long over all. It is also desirable to have another pair for circular work, with curved blades, about nine inches long. The sheet of brass should be about an inch larger each way than the design to be worked upon it, so as to allow of a little of the pitch being pushed up on to it. Brass as it comes from the mills is in a close coil, it requires, therefore, to be flattened out before it can be worked upon. This is rather a puzzling thing for an amateur to do himself, for without he has a good deal of skill, the plate will become worse instead of better under his hands, particularly if there happens to be a "buckle" or loose place in it. The plan I adopt is to take my plates to a neighbouring tinman, and get him to run them through his rolls; this saves me much trouble, and they come home beautifully flat. If the amateur wishes to do them himself, he will find a planishing hammer, Fig. 1, the best tool to work with. The plate must be supported by an anvil with a perfectly level face. The hammer should be held close up to the head, and great care must be taken that it falls perfectly flat on the plate, or what are called "half moons" will occur, which will effectually spoil the plate for chasing. It is undeniably difficult to reduce a brass plate to a perfect plane with the hammer alone, and as the description of how to cure all the irregularities plates are subject to would take up too much space in these papers, I must refer my readers to Vol. I., p. 414, of Holtzappfel's "Turning and Mechanical Manipulation," where they will find an excellent description of how the work should be performed. Before working on it, the plate must be polished to a certain extent—the final polish, or "glossing up," being left until the chasing is finished. If the whole of the polishing was left to the last, some of the finer markings would inevitably

be destroyed, which would detract greatly from the beauty of the work. The professional has his plates "sanded" before he works on them: this is done by fine Trent sand, used with a "bob," or leather-covered wheel running in a sort of lathe. The sand is moistened with a few drops of lard oil. This removes the rough surface of the brass, and brings up a dead polish very suitable for taking the design. If my readers have not the convenience for doing this, they can prepare the plate sufficiently well by rubbing it the way of the grain with No. 0 emery cloth, until a good face is obtained, and then finish it with crocus or Tripoli applied with a felt rubber moistened with oil. The sanding is much the quickest plan where there are the conveniences for doing it.

There are several methods by which the design may be transferred to the brass, but as the one I use exclusively answers very perfectly, I shall content myself with describing it. It is as follows:—

Pour a little spirits of turpentine on the centre of the plate, and distribute it with some cotton waste, or a piece of rag, and let it dry; then lay the design on the plate, with a piece of blue carbonic paper under it. Place some weights on it, and trace the outline carefully with a hard pencil. A piece of card or thin wood should be under the hand during this operation, to prevent the fingers leaving marks on the brass. After the outline is completed, some persons go over it again with an etching needle, or steel point, to secure the outline, and prevent its being erased. Perhaps it is safer for the beginner to do so, though I do not adopt this plan myself.

We now come to one of the most important parts of the work—namely, securing the brass so that it can be readily operated upon. This is done by fixing it to some suitable substance with a cement made principally of pitch. Professionals use a slab of stone or a block of iron as a bed for the cement, whicht they melt in an iron pot, such as plumbers use for melting lead, and pour on to the stone with an iron ladle until it is about an inch thick. This answers perfectly; but the cement must be removed from the stone and remelted when a fresh plate has to be laid down. On the whole, I prefer a pitch pan, which is merely a shallow pan, say about 15 inches long, 12 inches wide, and 1½ inch deep, of tin or galvanized iron, filled with the cement. Whichever plan my readers adopt, they will require some support for the stone or pan. The best I know of is a bag made of canvas or stout duck, and filled about three parts full of sand, free from stones. This helps greatly to deaden the noise, and gives solidity to the work. A convenient size for this bag is 14 inches long 10 inches wide, and 2 inches thick; it keeps its shape better if it is made with a "riser" for the sides—that is, a separate piece inserted between the top and bottom, as mattrasses are made.

Another most convenient support for the pitch is a "chaser's bowl," shown in Fig. 2. It is made of cast iron, and the upper side is hollowed out to receive the cement. A cushion is used as a support for it, as shown in the illustration. To make this take a ring of ½ inch iron, 7 inches across, and wrap it round and round with rag torn into strips, or with flannel list, until it is increased to from 2½ to 3 inches in thickness. For small articles this is a most convenient arrangement, as the work can be tilted to any angle that may suit the workman, and readily turned in any direction: it is very much used for hollow work.

The cement used to fasten down the work plays a very important part. It must not be too hard, or it will not hold the brass firmly, and will splinter under the blows of the hammer, nor too soft, or there will not be sufficient resistance to the tool, and the metal will be indented too deeply. Mr. Gawthorp makes a cement of special excellence. It is remarkably tenacious, and of a nice medium consistency, but has the disadvantage of being costly. This may be reduced by filling the pan about three parts full of ordinary pitch, and filling up with the cement.

As my readers may like to make their own pitch, I will describe the best methods I know of doing so: Equal parts of Stockholm pitch and plaster of Paris make a good, useful cement, particularly if a piece of Russian tallow be added. This cement is rather too hard without the tallow. I have always made it by "rule of thumb," so that I cannot give very definite proportions. Another very good recipe is: Pitch, 6 ozs.; brickdust—*i.e.*, bath-brick pounded fine—8 ozs.; resin, 1 oz.; raw linseed oil, 1 tablespoonful. This is very pleasant to work with. Cement, however made, is affected by the temperaure, becoming harder in cold and softer in warm weather. The addition of tallow, oil, or yellow wax will soften it, or it can be hardened by adding more pitch or plaster of Paris. The pitch should be melted at a low heat, to prevent its being burnt or set on fire. As soon as it is well melted the other ingredients may be added by degrees, and when the whole has been well stirred it may be poured or ladled into the pan or on to the stone. As soon as it is sufficiently stiff the plate may be laid down upon it, care being taken that the metal touches the pitch all over and that there are no air bubbles underneath. If this is not attended to, the metal will give way where it does not rest on the pitch, and render good work impossible. In this case there is nothing to be done but to take the plate up, clean it, and lay it down again in a better manner. If the pitch has been used before, the surface must be warmed and

smoothened down with an old knife or other suitable tool, which must be wetted to prevent the pitch adhering to it. In default of anything else, the pitch may be warmed by holding a hot iron over it, taking care not to touch it. As I happen to have one o Fletcher's large blow-pipes, I always use this for softening my pitch before laying a plate on it, and certainly nothing can answer better; but where this is not at hand, I would recommend a very clever little self-acting blow-pipe, to be obtained from Mr. Gawthorp, which is a very neat and effective tool. I ought to say here that the plate should also be warmed before it is laid down on the pitch. This must be done with care, so as not to disturb the outline; unless, of course, it has been etched over previously. If the plate is of any size, it is a good plan to push a little of the pitch on to the edges of the plate. This helps greatly to keep it down, and prevents it springing off, which it is apt to do, particularly if there is a good deal of matting to be done. Hollow work is filled with pitch, which is allowed to set before it is laid down on the block or bowl. The pitch is melted out when the work is finished. As soon as the pitch is cold the plate is ready for chasing.

The tools required for chasing now claim our attention. The most important is the hammer (Fig. 3). It will at once be perceived that it is very different to ordinary hammers, both head and handle being peculiar. The handle should be of lancewood, which gives it lightness and flexibility; at the same time it has sufficient strength to enable a good blow to be given without its breaking. I have two in general use — one weighing, handle and all, 3 ozs. This I use for chasing and all light work; the other weighs $5\frac{1}{2}$ ozs., and is only used for the preliminary beating up of large surfaces, such as fruit, birds, bodies, etc. If one only is to be used, the smaller size is preferable to the larger one. The hammer should be held with the bulb in the palm of the hand, and the forefinger stretched along it. This will enable the blows to be delivered with great nicety. The face of the hammer should be from $\frac{7}{8}$ inch to 1 inch in diameter.

The next tool in importance is the tracer. The outline of the edge of these is slightly elliptical and more or less blunt, though a few sharper ones are required for cutting veins in leaves and other similar purposes. Several of these will ultimately be wanted, ranging from $\frac{1}{16}$ inch to $\frac{3}{8}$ inch. Curved tracers, of various sizes and different curves, also come in very useful. These the amateur can readily make for himself after having obtained one of each sort for a pattern. Cup or ring tools are also in considerable demand as they cut a complete circle at a single blow: the smallest size of all may be used for matting with excellent effect, and the others whenever a small circle is required. They are not generally made larger than $\frac{3}{8}$ inch. Ball tools are just the reverse of these, the end of the tool forming half a ball. A small size of this sort will also make a very useful mat. They are mostly used for beating up the outline made with a ring tool. Oval tools are much the same as ring tools, except that they make an oval mark instead of a circle. Ornamental tools, though not very useful to the amateur, yet claim to be mentioned here. These are generally of some size, and have a figure or pattern engraved on the end. Professional chasers use them a good deal, singly or in combination, for borders and other similar work. In describing Mr. Gawthorp's designs, I shall point out one or two places where it would be desirable to use them.

Half-round tools, though not absolutely necessary, are still useful, particularly where a clean-cut half circle is required to be repeated over and over again. I have a complete set of these, and I am continually using one or other of them.

A sharp-pointed tool called a pick is necessary for a variety of purposes; skilfully used, it will make a very good mat; and several different patterns can be cut with it. The tools I have now described all belong to chasing proper, and should not exceed 4 inches in length, as they are more manageable than longer ones.

A short time since I met with a very handy tool, Fig. 4, the edge forms a segment of a circle—the face side is chamfered off, and the back rounded. This tool will cut both straight and curved lines with equal facility—a small size is particularly useful for going round small and difficult curves. A few words on tool making will be advisable here. Round rods of steel that are sold specially for tool making may be used for round ended and similar tools. "Brindles," or pieces of steel roughly forged into shape, are also sold for the express purpose of being converted into chasing tools. They are of various shapes and sizes, and an assortment of these should always form part of a chaser's stock. If required, the end is first forged, and then ground or filed to the required shape, generally filing or grinding is all that is necessary. When finished, they should be heated red hot and plunged end foremost into water, then polished, and the temper drawn to a brownish yellow. The best thing for an amateur to do before commencing on a regular design is to lay a piece of brass down on the pitch as I have described (this, of course, need not be polished), and endeavour to cut a clear even line upon it. The tool should be held firmly in the left hand, the third finger resting on the plate, and the tool pressed by the thumb against the first and second fingers which should be stretched along it. The

second finger is steadied and supported by resting on the nail of the third. The hammer should not be held too firmly, and the blows should be light and follow one another rapidly. A light tap, tap, tap, is all that is required. If the corner of the tool be now raised, and a few gentle taps given to the tool, it will progress gradually along the line to be cut, leaving a clear even mark behind it, without any stitchy appearance. The leading corner of the tool should always be raised more or less. In cutting a straight line, only about two-thirds of the tool should touch the brass, but in going round curves this must be reduced in proportion to the size of the curve. A straight tracer, about $\frac{3}{16}$ of an inch wide, is a good tool to commence with, and very sharp curves may be cut with it if the leading corner be well raised in going round them. In cutting curved lines, the tracer should be inclined *from* the centre of the curve, that is, outwards, in proportion as the curve is sharp or otherwise. Though I have recommended the amateur to use a straight tracer for his first attempts, when he has acquired the use of it, and can cut lines clearly and easily in all directions, he will often find that a slightly curved tracer will be found easier to work with, remembering, of course, that the curve of the tracer must be in the direction of the curve to be cut. As a general rule the outline should be firm and decided, and if the design be a geometrical one, of even thickness throughout, the tracer, therefore, must be neither too sharp nor too thin. I must again impress upon my readers the importance of thoroughly mastering this part of the work, as so very much depends upon it—indeed, it is the keynote to the whole process. If the design consists, say, of a group of flowers or birds, the outline should vary in thickness, and an attempt should be made to give an effect of light and shade by making the outline thicker where shadows would come in a drawing, and so produce an appearance of roundness and form. In clever hands it is astonishing how much may be done in this way, and what an artistic effect results, though the plate be kept perfectly flat.

FIG. I.—PLANISHING HAMMER.

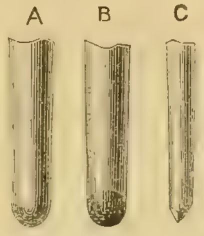


FIG. 4.—TOOL FOR CHASING.
A, Face; B, Back; C, Side.

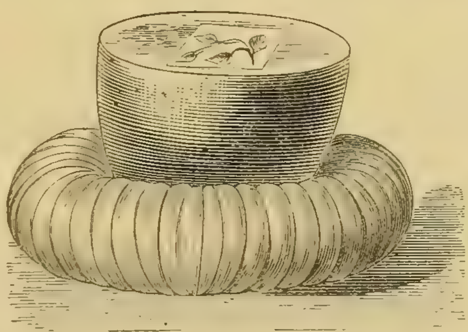


FIG. 2.—CHASER'S BOWL AND CUSHION.

FIG. 3.—CHASER'S HAMMER.

In chasing, the right arm should be well raised, and the bulb of the hammer brought to the level of the top of the tool, this tends to ensure the head of the hammer falling directly downwards on the tracer, and there will be no tendency to knock the tool on one side. The hammer should be made to rise and fall by the motion of the wrist and not of the elbow; and the strength of the blows should be varied according to the effect it is desired to produce. In working round a very sharp corner, the blows must be very light, or it will be difficult to get round at all, the mere weight of the hammer being generally sufficient. The easiest line to cut is a slightly curved one, a straight one presents a good deal more difficulty. The blows of the hammer should be almost invariably light ones, it being much better to attain your object by a series of light blows than by a few heavy ones, and you can by this means regulate the effect produced so much more easily. Where, as in this case, everything depends on delicacy of manipulation and correctness of eye, it is difficult to express in words the exact method of working, and my readers would therefore derive great benefit from a practical lesson from a good workman if they are in the way of obtaining it, they will then better understand what I have written.

FIG. 5.—MATS.
A, Freezing Tool.

The chasing being satisfactorily accomplished, the next thing to consider is how to deal with the ground on which the design is drawn. To produce a proper contrast and give relief to the figures, some kind of grounding, or matting, as it is termed, is generally required. Here we have a different style of work

altogether. The tool is no longer traversed along the metal, but single blows are given to it, leaving an impression of the figure cut on the end of the matting tool. These impressions may be made either close together, when it is called a close mat, or at some little distance from one another, forming an open mat. Of course, the latter takes the least time to do, which is a great advantage where large spaces have to be covered, but the close mat produces the best effect. More skill is required in matting than would be generally supposed, the great object being to produce a perfectly even effect over the whole of the ground. It will greatly help towards this end if a file mark be made on one side of the tool, and this mark be always kept under the thumb, the weight of the blows given to the tool should also be as nearly alike as possible. In Fig. 5, I give impressions of different kinds of mats; they will all do either for close or open work. When they are worked close, however, they often produce quite a different effect to what they do when worked open. A, for instance, which makes a small star, when worked close, gives a beautiful frosted look to the work, and is consequently called a "freezing tool." This is very much used by silver chasers. I may here mention that it is very desirable that the design and matting should bear a due relation to one another, as regards the space they each of them occupy, and the matting be suited to the design, so that together they produce an harmonious whole. As soon as the matting is completed, the plate may be taken off the pitch. This is easily done by raising one corner with a screw-driver, or similar tool, and then tapping the edge of the metal with a hammer, it will spring off, generally without any trouble. Avoid trying to take up the plate unless the pitch is quite cold, by doing so you would probably bend the plate and get into difficulties generally. Some pitch is sure to adhere to the work. The best way to clean it is to warm it until the pitch softens, and then wipe it off with cotton waste. A few drops of petroleum and a fresh piece of waste will remove the last traces of pitch.

The plate will be, in all probability, more or less distorted, and to reduce it again to a level will require some care. It is a good plan to have a board about an inch thick, on which is nailed a piece of felt. The nails should be on the edges of the board to avoid damaging the plate. If the plate be laid face downwards on this, and a mallet be carefully used on the back, all the irregularities may be reduced, if not entirely removed. If any remain, lay the plate face upwards on an anvil, and give a blow with a straight tracer on any part of the outline which appears too high. The tracer must be held upright, and the blows must be light. This should bring the work again to a perfect level. It is ready now for the final polishing.

For "glossing up" the work, the professional polisher uses Sheffield lime, applied with a "dolly." A little grease is used at first, and afterwards the dry lime alone. Sometimes he finishes with a "dolly" and rouge. Sheffield lime is lime calcined and ground to a fine powder. Other lime will answer to a certain extent, but lime from the neighbourhood of Sheffield is much preferred.

To make a "dolly," cut a number of circles about 4 inches diameter out of calico, and two circles from stout leather, about 2½ inches diameter; place these on each side of the pieces of calico, and sew them through with thongs of leather, or rivet them with copper rivets.

This method of polishing involves either a lathe or a regular polishing head. It is not advisable to use a lathe if it is a valuable one, as it is sure to be more or less damaged by the polishing powder finding its way into the bearings and cutting them away; very useful polishing heads are sold by Messrs. Churchill and Co., *Finsbury*, which can easily be put in the place of the ordinary lathe head when required. They have a long taper screw on the mandrel on which "dollies," "bobs," or brushes can be fixed. After all, I think that it is hardly worth an amateur's while to do the final polishing himself, particularly as he can get it done so readily and cheaply by a professional. To do it really well an engine is required, as it takes a great deal of speed, and consequently power; and it is one of the dirtiest and most disagreeable processes I know of. The dry lime flies about everywhere, infesting the hair, eyes, and mouth, and covering the clothes with the white powder. Though I have a room specially devoted to polishing, it is only in exceptional cases that I do more than "sand" my work.

Where neither a lathe nor polishing head is at hand, a very fair polish may be obtained by using the German "Putz Pommade" with a soft cloth.

(*To be continued.*)

BEE-HIVES AND BEE-FURNITURE.

By WALTER J. STANFORD.

VI.—MANIPULATING HOUSE—HOW TO BUILD ONE—CIRCULAR SAW FOR BEE-HIVE WORK.

A MANIPULATING house of some sort is necessary in an Apiary, large or small. Very often an old outhouse will answer the purpose, but it must be near the hives to be of real use. Nothing is so aggravating as to have to run a long distance to fetch

some forgotten necessary while examining a hive, and nothing more tiring than to have to carry heavy loads of honey more than ten or twenty yards on a hot summer's day. I tried to do without a special house for some time, but had to give in. You must have some place near the hives where you can keep odds and ends, extract, take sections, etc., etc., and as soon as you have six or seven hives, construct a manipulating house without further delay. The one I am going to describe is an exact facsimile of my own, which I have found in all respects to be a very convenient size, giving plenty of standing and moving room, and the 8 feet height in front can be utilized for shelves for odds and ends. The outside dimensions are 6 feet long, 5 feet 6 inches broad, 8 feet high in front sloping to 6 feet at the back. The timber necessary to make one to these dimensions is as follows :—

Fifteen 12 feet by 9 inches by $\frac{3}{4}$ inch white deal, planed one side and weather boarded ; two 14 feet by $2\frac{1}{4}$ inches by $2\frac{1}{4}$ inches white deal ; six 12 feet by $2\frac{1}{4}$ inches by $1\frac{1}{2}$ inch white deal ; two 14 feet by 3 inches by $1\frac{1}{2}$ inch white deal ; two 12 feet by 9 inches by $\frac{3}{4}$ inch rebated V jointed white deal ; one 6 feet by 9 inches by 1 inch white deal. Also three sheets of corrugated iron 6 feet 6 inches long and 26 inches broad, No. 24 B. W. G.

Figs. 80 and 81 clearly show the construction of the house. Fig. 80 shows it completely finished with door and window in their places. Fig. 81 shows what it would look like if the corrugated iron roof, the sheeting, the door and window were taken away. The simplest and easiest method of building it is not to make the whole skeleton first and then sheet it, but to make and sheet the two long sides separately, and then join them by nailing on the back and front sheeting. The whole, when complete, is meant to stand on four stakes, one at each corner, or, better still, on four flat stones. Its own weight will keep it steady, and the posts can never rot in such a position. Select four good stones about 6 inches by 6 inches and 8 inches deep. Sink these in the ground, the side ones 6 feet apart, and the front and back ones 5 feet 6 inches apart. Set them perfectly true in every direction with a straight edge and spirit level. Next out of one of the 14 feet by $2\frac{1}{4}$ inches by $2\frac{1}{4}$ inch pieces, cut two posts, one 8 feet long and the other 6 feet. Lay these on the ground, and with a couple of laths tack them 6 feet apart. The 8 feet post will project 2 feet at one end, and be level with the 6 feet post at the other. Begin at the bottom or level end and nail on the weather boarding, thin end downwards. The thin end of the next board will overlap the thick end of the first one about $\frac{3}{4}$ inch. When you have eight lengths nailed on, cut a head piece out of one of the 3 inches by $1\frac{1}{2}$ inch scantlings. Slope off the tops of the two posts and nail it on. It will project $\frac{3}{4}$ inch on the inside. Finish the sheeting, turn the whole over and cut a diagonal to fit into the top corner and be nailed near the bottom of the shorter post. Nail the weather-boarding to this where it crosses. The other side with the window is similarly treated, but in addition to the two $2\frac{1}{4}$ inches square uprights laid on the ground at first, two must be cut out of the $2\frac{1}{4}$ inches by $1\frac{1}{2}$ inch pieces for the window which is 1 foot 7 inches wide. Tack these four temporarily in their places top and bottom, the two large posts 6 ft. apart outside, and the two smaller ones 1 foot 7 in. apart inside in the centre of the space. Begin at the bottom again and nail on the boarding. When four 6 feet lengths are on, leave space for the window by nailing on four short lengths on each side. Three of these can be cut off the ends of three 12 feet boards. The remainder of these will be wanted in front for the short pieces necessary to leave space for the door. The other five can be got by cutting up a 12 feet length. Cut out and nail on a head-piece as before, and complete the boarding. A diagonal strut is not wanted for this.

Having got the two sides completed, you will want help to erect them and to sheet the back and front. Stand the two sides on their stones and nail them temporarily in their places, 5 feet 6 inches apart, with a few laths back and front. Begin at the bottom of the back and nail on the sheeting upwards. When you have on enough to make the whole stand fairly firm, leave it, and come to the front. The door need only be 6 feet high and 2 feet 3 inches wide. Another upright will therefore be required in front to nail the short lengths of sheeting to where space for the door is being left. Before this is fixed, however, the front and back head-pieces will have to be nailed on. These are got out of the 3 inches by $1\frac{1}{2}$ inch scantling, and are nailed with long nails to the $2\frac{1}{4}$ inches square posts with the 3 inches side showing in front and the 1 inch side on the top, a little piece being taken out to allow for the projecting $\frac{3}{4}$ inch of the side head-pieces. Cut the post for the door out of $2\frac{1}{4}$ inches by $1\frac{1}{2}$ inch scantling, allowing 6 inches extra length to sink in the ground. Where it meets the ground and below it this post must be well charred to prevent it rotting. Nail it under the head-piece to fix it at the top, and well ram earth round it at the bottom. Begin at the bottom and nail on he short pieces in front, leaving space for the door. will take nine short pieces and three long pieces to sheet the front. Complete the boarding at the back, and run a diagonal stay across it from top to bottom, nailing the sheeting to it from the outside. Cut a $2\frac{1}{4}$ inches by $1\frac{1}{2}$ inch piece long enough to nail across the centre of the roof to support the corrugated iron in the centre. Nail

on the corrugated sheets with long galvanised nails, white leading the nail holes. The nail holes should only be punched on the *top* of the ridges if the roof is to be watertight. To complete the doorway, in between the door-posts nail a head-piece and a sill. Make an ordinary ledged door to fit, using ends of the weather boarding for ledges, and rebating and V jointing the sheeting. Hang it with T hinges to the short lengths of sheeting as shown, Fig. 81. Fit on a lock and latch, and nail a lath inside to the $2\frac{1}{4}$ inches square post as a stop, and three outside round the frame of the door. The window is the only part necessary to complete the whole. Nail between the window posts a head-piece and a sill about 2 feet 7 inches apart. Make an ordinary mortised sash to fit this space. Two long panes are less trouble to provide for than four smaller ones. This should be hung to the posts by a pair of pivot hinges, so as to allow the window to be turned completely round. This is necessary, so that if any bees collect on the glass inside, by simply turning the window round you can turn the bees out. The whole should now get at least three good coats of paint. Shelves can be fixed inside as they are wanted.

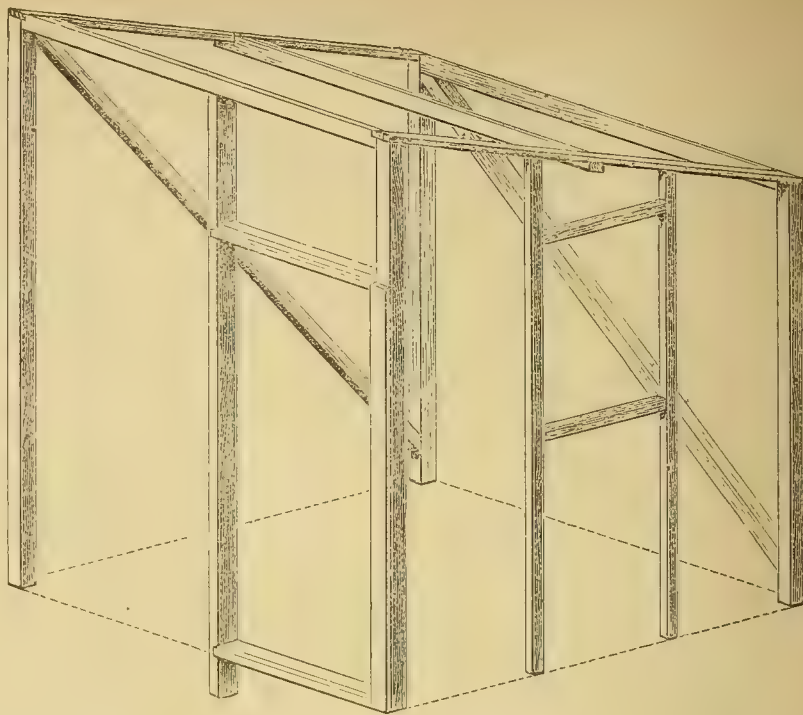


FIG. 81.—SKELETON OF MANIPULATING HOUSE.

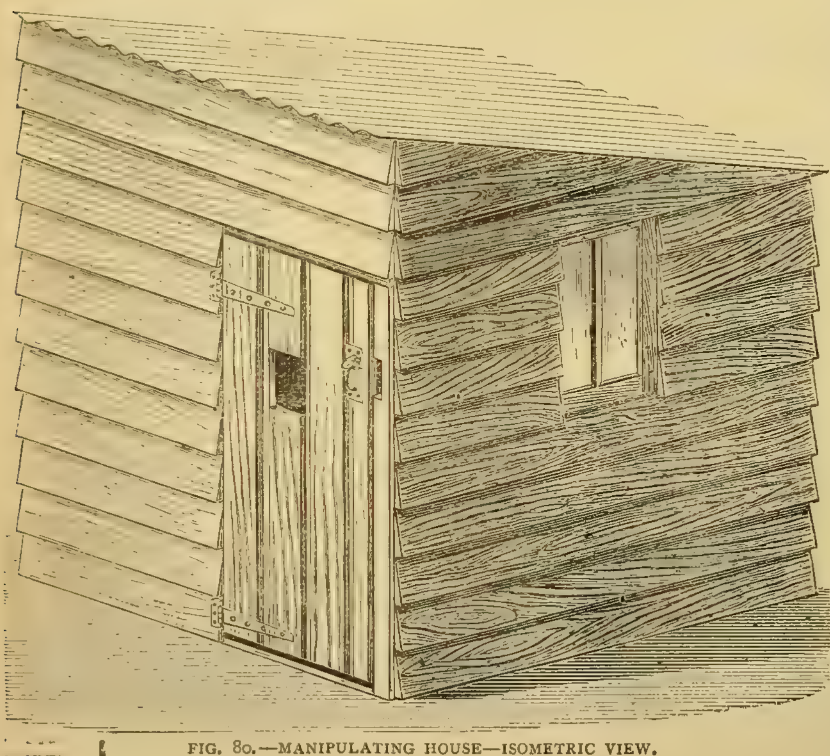
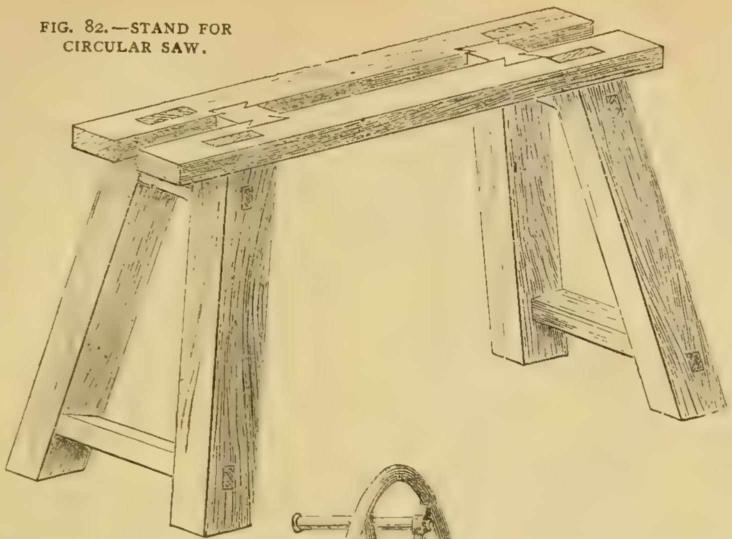


FIG. 80.—MANIPULATING HOUSE—ISOMETRIC VIEW.

The next and last item on my list is a circular saw suitable for bee-hive work. The one I am about to describe is meant to be driven by hand power, and that is the only objection possible to make to it, but with a treadle saw

it is utterly impossible to rip the long length often wanted that can be cut with this machine. It cuts easily up to 1 in. thickness, and thicker even at a pinch. I have taken my dimensions and design from a similar saw designed and constructed by Booth Brothers, *Dublin.* The wheel, axle, and saw, Fig. 84, are sold separately for £3, and mounted on a strong iron stand at £5. As £2 is a consideration in these hard times, I should advise you to order only the wheel, axle, and saw, and then to make the bench and set it up yourself. The wheel sold at £3 weighs 90 lbs., and is 30 inches in diameter. The saw is a 12-inch. Fig. 82 shows clearly the construction of the stand for this. The best material to use for it is pitch pine. Cut out and plane up square two pieces 3 feet 6 inches by 4 inches by 3 inches for the top long pieces, and two 4 inches by 3 inches by 1 inch for the short top dovetailed pieces. Dovetail these four together as shown, keeping the outside edge of the short pieces about 8 inches away from the ends of the long pieces, and the outside width on the top rather under 10 inches.

FIG. 82.—STAND FOR CIRCULAR SAW.



The legs are the next and most tedious part of the whole. They must be splayed out in every direction to keep the whole firm; the mortises therefore, in the long top pieces will have to be cut to suit this splay, which will require a little care. Cut out four pieces of 4 inches by 3 inches pitch pine 2 feet 8 inches long. Plane and square them up. The stand, when finished, should be about 2 feet 6 inches high, but an extra 2 inches will be wanted to allow for cutting off the ends of the tenons, and the bottom slope on the ground. First mortise the legs into the top, and this is easily done once you have the angles of splay. If the legs splay 6 inches backwards and 3 inches outwards, the whole will be as firm as necessary. Procure two bevels, and set them to the two angles by the method described in my first paper in Part 64, where the angle of splay had to be got for the legs of the

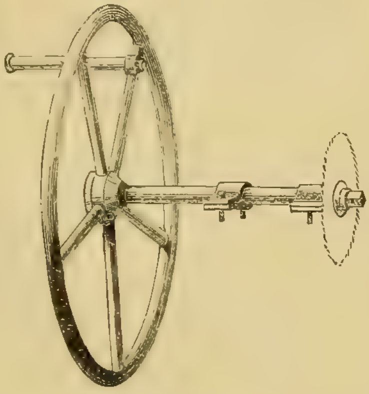


FIG. 84. WHEEL, AXLE, AND SAW FOR CIRCULAR SAW BENCH.

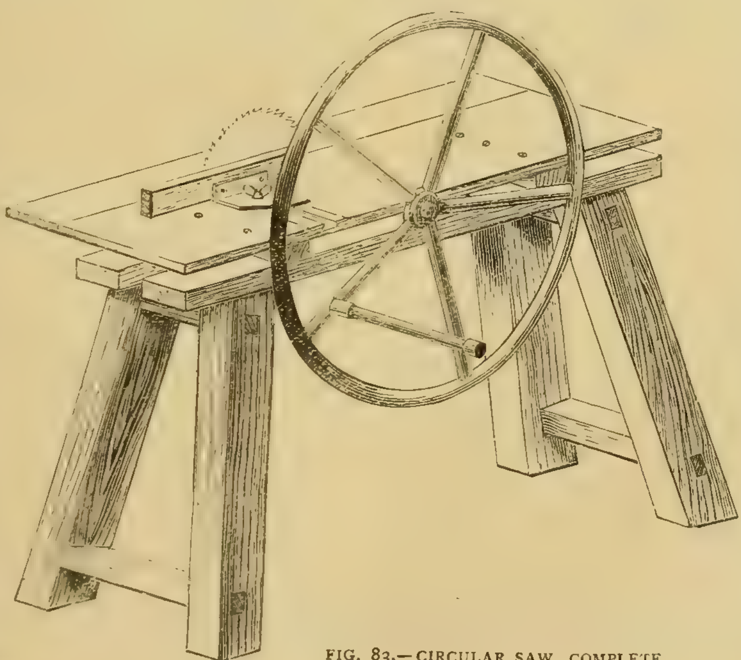


FIG. 83.—CIRCULAR SAW, COMPLETE.

floor board. Having got these two angles set on the bevels, use them instead of a square in marking for the tenons and mortises. With a little care and no hurry, success is certain. Each pair of legs has now to be tied together by two cross-pieces mortised in as shown Fig. 82. These will be strong enough if cut out of 3 inches by 2 inches scantling. The mortises are square with the face of the legs and are cut quite straight through. The tenons are also square with the face of the cross-pieces, but the 3 inch splay angle will be required to cut the butt of the tenon to allow for the outward splay of the legs. Glue and wedge the whole up, clean off the tenons and cut the legs to make it stand firmly. Eight inches away from the ends of the top, screw on two 3 inches by $1\frac{3}{8}$ inch pieces 16 inches long across the top. The table which is in two parts is screwed to these. For the table plane up two pieces of 1 inch pitch pine, one 11 inches wide, and the other 5 inches, and both 3 feet 6 inches long. Fit these in their places. The 11 inch piece is screwed to the cross-pieces level with their ends. The 5 inch width is not permanently fastened at all, but held in its place by a dowel in each cross-piece. It can then be easily lifted up at any time to oil and clean or to take out and change the saw.

Now fix the saw axle and handle exactly in the centre of the whole, adjusting it so as to allow a bare $\frac{1}{16}$ of an inch between the face of the saw and the edge of the fixed part of the table. The screws which hold the saw to the stand are strong and nut-headed, so that they may be more securely fixed than they could be with a screw-driver. Stand behind the whole bench so as to have the big wheel on your left, and mark the end you are touching "Back," and the other "Front." Plough out a cut $1\frac{3}{16}$ inch wide and $\frac{3}{8}$ inch deep right across the 11 inch width of the table 12 inches away from the "front" end. On either side of this cut a rebate 1 inch wide by $\frac{1}{8}$ inch deep. Forge two plates $10\frac{3}{4}$ inches by $1\frac{3}{4}$ inch by $\frac{1}{8}$ inch, and screw them into these rebates so that they project $\frac{1}{16}$ inch each over the ploughed cut. The fence is made out of $\frac{1}{4}$ inch iron $5\frac{1}{8}$ inches by $4\frac{3}{4}$ inches turning up 2 inches of it at right angles. In the 2 inch part three screw holes are punched, and in the centre of the other part a $\frac{1}{2}$ inch hole is punched. One of the corners of this last part can be cut off to take off the square look of the whole. Cut a piece of pitch pine 9 inches by $2\frac{1}{2}$ inches by 1 inch and screw it to the 2 inch plate with three screws. Procure a $\frac{1}{2}$ inch bolt with a head about $1\frac{1}{4}$ inch wide. File off two opposite places on the head till it is only 1 inch in diameter. This bolt moves up and down in the groove cut for it on the table, passes through the $\frac{1}{2}$ inch hole in the iron plate, and can be fixed in any required position by screwing up the little winged nut on the top. A piece of $\frac{1}{8}$ inch iron, about $\frac{1}{2}$ inch by $\frac{1}{2}$ inch, must be welded to the under side of the guide, with its centre exactly in the centre of the bolt hole. This must then be filed to fit *exactly and perfectly square* into the space between the $\frac{1}{8}$ inch plate. On this last piece depends the accuracy of the whole guide, and if this is not absolutely perfect the saw will cut planks wedge-shaped, and for this reason it is almost better to buy the whole of the iron part in a casting, and adapt the groove and $\frac{1}{8}$ inch plates to suit it. Fig. 83 shows the whole complete.

I shall be very pleased to give any further advice or help in "Amateurs in Council."

(*Concluded.*)

WOOD-CARVING IN IRISH BOG OAK.

By ALEXANDER WATT.

III.—Carving a View Brooch (*Continued*)—Mounting the Brooch—Staining and Polishing Bog Oak—Carving a Harp Brooch—the Brian Boru Harp.

CARVING A VIEW BROOCH, *continued.*—In my last paper, I described a plain and simple border for the view brooch; I will now suggest a few other patterns which will be equally suitable for the same purpose, and will require but moderate skill in their treatment. One of the simplest of these is shown in Fig. 8. The small stamps, or punches described in the first paper of this series, are now brought into requisition, and applied in the following way—the border, however, must first be bevelled, smoothed and burnished as bright as possible. We must next trace with a pencil a serpentine line, to represent the trailing stem of a shamrock plant, and a series of shorter lateral lines, slightly curved, for leaf-stalks, on each side of the main stem—not opposite each other, but alternately left and right, until the entire series is complete. When this part of the design is finished, the pencil marks must be neatly cut through with the graver, at a moderate depth; having done this, the shamrock stamp is to be moderately heated in the flame of a candle, or small benzoline lamp, and, being placed in the proper position at the end of one of the leaf-stalks, it must be pressed gently and steadily into the wood, so as to leave a clean, but not too deep impression. It is important that the shamrock leaves be placed so as to properly follow the position of each of the short curved lines, which latter should exactly meet the division between the two lower leaflets of the shamrock. If it be preferred to introduce the acorn into

this design, the small acorn punch previously described must be used, and in this case the shamrock and acorn may be placed alternately, as in Fig. 9, which produces a very pleasing effect when neatly and artistically done.

A pretty modification of the border design given in Fig. 6 is affected in a very simple way, thus: After having outlined the scrolls, as shown in Fig. 10, and finished the border as before directed, we next proceed to make a few equi-distant diagonal cuts with the graver between each pair of scrolls, and these must be followed by cross-cuts in the opposite direction, great care being taken to make these cuts as uniform as possible, and not too close together—for a reason that will be apparent presently—so as to leave diamond, or lozenge-shaped spaces between the lines. Having done this, we must form a *bead* or rounded projection in the centre of each space, with a little tool, or punch prepared as follows: one end of a piece of brass or iron wire, about $\frac{1}{16}$ inch in thickness and 3 inches long, is fixed into a handle. The free end is next to be filed flat, and holding the wire (flat face upward) firmly against a table or bench, a hollow must be formed by means of a small scorper—a half-round tool used by engravers, and the blade of which is shown in Fig. 11. In forming the hollow with this tool, the best plan is to place the end of the wire nearly in a level with the bench, and there hold it firmly; now take the scorper firmly in the right hand, bringing the thumb nail within $\frac{1}{8}$ inch from its point, then turn the wire slowly round and round so that the cutting point of the scorper may gradually cut into the metal, and form the requisite concavity. To ascertain whether the hollow formed in the end of the wire is deep enough, and of the proper form, gently heat the point in the candle-flame, and press it lightly into a piece of wood (end-way up) when, if properly done, a neatly-rounded bead will be seen. It will now be necessary to file the end of the wire all round, so as to make it taper a little, which should be done with a very fine file, and care must be taken to file up to, but not into, the hollow. To apply this tool, or "bead punch," it is to be moderately heated as before, and, being held upright, it must be pressed gently into each of the diamond spaces between the cross-lines referred to, reheating the tool as often as may be necessary. It is important that this part of the work be done with great nicety and perfect uniformity. In order to get accustomed to the use of the beading tool, it is well to practise upon a small piece of waste bog oak or any hard timber—endway of the wood—which should first be cross-cut in the manner indicated.

Mounting the Brooch.—This term is applied by jewellers to the fitting of bog oak brooches with the fastenings, known as the *joint*, *catch*, and *tongue*, by which they are attached to ladies' apparel. Complete sets of these can be purchased ready made at the jewellers' supply shops in Clerkenwell, and may be readily attached to the back of the brooch by the amateur carver himself; a little addition, however, must be made to the plates which carry the joint and catch, in the shape of a small vertical plate, soldered on to the back of each of them—these plates being intended to set into a narrow groove or niche, which must be cut in each end of the back of the brooch with a thin *flat* scorper. Any working jeweller will understand what is required when told the purpose for which the additional plates are required for the joint and catch. To connect these portions of the brooch mounts, a groove must be cut deep enough in the wood (without perforating the scene) to allow the vertical plate to enter freely, leaving the joint-plate flush with the wood. Each of the vertical plates should be *barbed* on both sides, which may readily be done either with the graver or scorper, by forcing the point of the tool into the plate in several places, and turning up the fragment of metal thus partially removed, so that the surface becomes rough, or barbed. Now hold the joint-plate with a pair of pliers, heat it over a small flame, and then touch the barbed plate all over both sides with a piece of shellac. A little shellac must next be forced into each of the grooves, which is conveniently done with a thin strip of metal, heated, and brought in contact with a piece of shellac and then worked into the niche in such a way as to coat the narrow orifice thoroughly, without filling it up with the shellac. Having prepared the barbed plates and their respective grooves in this way, the joint and catch, one by one must be heated as before, and then quickly forced into its groove until the horizontal plate of each rests perfectly flush with the wood at the back of the brooch. If this be done expertly, the attachment will be complete, and nothing but severe usage will cause the parts to come asunder.

Staining and Polishing Bog Oak.—It may be well at this stage to give some details as to the method of finishing bog oak work generally, after it has left the carver's hands, to give it a more brilliant appearance than can be effected by tools alone. Now, although good bog oak is black, when carved it presents a somewhat rusty unfinished appearance which is not pleasing to the eye. To remedy this, it is usual to adopt an artificial method of treatment which greatly enhances the beauty of the work. Professional bog oak carvers commonly dip the finished articles in a black dye or stain, composed of nutgalls, logwood, gum tragacanth, copperas (sulphate of iron), and sometimes other ingredients; but for the amateur's purpose the best and blackest ink made hot, and with a little gum tragacanth added, will answer well.

Having made this mixture boiling hot, the view brooch or other articles, attached by a piece of wire or string, are immersed for a few minutes, then removed and allowed to dry. When *nearly* dry, a soft long-haired brush—a "shining brush" such as is used for polishing boots will do admirably—is well rubbed all over the piece of work, back and front, until a brilliant polish is obtained. In the case of mounted articles, as view brooches, for example, the staining and polishing should be applied before the mounts are attached.

Carving a Harp Brooch.—A slice of sound, close-grained bog oak, about one-quarter inch in thickness, is first obtained, and upon this is traced in pencil an outline of the harp it is desired to reproduce in miniature. Many differerent designs have been adopted

FIG. 8.—BORDER FOR VIEW BROOCH—SHAMROCK.

FIG. 9.—BORDER—SHAMROCK AND ACORN.

FIG. 10.—MODIFICATION OF BORDER IN FIG. 6.

FIG. 11.—SMALL SCORPER FOR FORMING HOLLOWS.

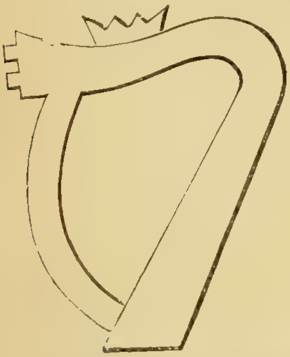


FIG. 12.—HARP BROOCH, "BRIAN BORU" DESIGN.

by the bog oak carvers of Ireland from a copy of the original Brian Boru harp (which is preserved in the Dublin Museum, if I remember rightly) to more ornamental or "fancy" forms dictated by the taste of the artist. Of these I give a few illustrations, commencing with the Brian Boru harp design, so far as I remember it, as a characteristic design for a bog oak ornament. This is shown in Fig. 12, and, as will be seen, is an exceedingly simple design to work out, and therefore well suited for a beginner. Having traced the pattern, the graver should next be passed lightly through the pencil marks, to preserve the outline. Several perforations should next be made in the centre space, which may be done with an American drill stock, using a keen-cutting drill suitable for wood for the purpose. These perforations will enable the operator to cut away the timber from this part by means of the small chisel. Those who possess a fret-saw, however, will naturally use that implement in preference. When the entire centre is cleared away, we must next proceed to cut away all the surplus timber from around the outer line, which is best done by laying the work on a level surface and chipping off small pieces of the wood at a time with the chisel, gently tapped by a light hammer. The curved part on the left should next be cut down to the extent of about one-sixteenth inch, and also the portion which is to form the crown, to the same depth. The space between the two projections on the head of the harp may next be cleared away, by using the side of a small flat file or fret-saw. The points of the crown may be formed with a small three-square file. At this stage it will be well to render the surfaces of the front and back smooth by rubbing them upon a sheet of

FIG. 13.—HARP WITH HEAD OF LEAVES.

glass paper, using coarse paper at first, and finishing with fine. The inner edge may next be filed smooth, using the rounded part of a half-round file for the curved surfaces, and the flat side for the rest. When this is done, the outer edge should be made smooth in the same way. The crown and the face of the harp may be rendered bright by means of the burnisher. To give an ornamental finish to the object, a wreath of shamrocks, as described for the view brooch border, may be adopted; and the piece of work may then be stained and polished as before stated. The mounting of the harp consists in fitting a silver or gold band accurately into the open space, and to this is soldered a sufficient number of silver or gold twisted wires for strings. This mounting is generally secured in its proper position by means of small silver pins, while the joint and tongue are attached in the manner before described.

Another design for a harp is shown in Fig. 13. The preliminary treatment will be the same as in that given for the Brian Boru harp—that is, all the surplus wood must first be cleared away. The head of the harp in this case consists of a group of leaves, to form which it will be necessary to make clean cuts with the chisel from the base of each leaf to its apex—first in the direction of the right hand outline, then reversing the position of the tool to the left, holding the blade of the chisel at an angle of about forty-five degrees in each case, so as to leave a hollow of this form ‿, but in order to relieve the stiffness which a too-rigid uniformity would present, we must scoop out one or two of the hollows, when about half cut down, by employing the scorper, the rounded edge of which applied to the apex of each leaf and a little beyond, will greatly improve the form. The hollows forming the leaves should also be of somewhat irregular depth, the two outer leaves being cut deeper (that is, sunk lower) than the intermediate ones. The scrolls may be formed as before directed, but it will be a great improvement to make a hollow cut with the scorper from the right hand scroll, nearly as far as the one on the left at the top of the harp. The hollow should not be too deep, and must exactly follow the curved outline of this part of the harp, and diminish in width to the left. The curved front of the harp should next be cut down about one-sixteenth inch or even a little deeper, care being taken to avoid cutting into the leaf at the upper end. This part may be slightly rounded with a file, and afterwards smoothed with glass paper, finally rubbing it with the burnisher. The body of the harp should be cut down $\frac{1}{32}$ inch to give relief to the scroll, and may be slightly bevelled with a file from top to bottom of the outer edge, but the widest part of this bevelled edge should not much exceed $\frac{1}{16}$ inch. The file marks must then be erased with glass paper, and the whole of this portion of the harp well burnished. When the student in this interesting art has mastered by practice the proper handling of the tools, and is capable of accomplishing creditable work, we should recommend him to direct his special attention to forming scroll-work designs, which at all times look pleasing, and are never more effective than when well executed in wood. He will do well, therefore, to look out for a few good examples of this class of ornamental work, which he may frequently see in moulded looking glass and picture frames, and make a few rough sketches of scroll-work for his future guidance.

In the next paper it is proposed to give instructions in the method of producing shamrock studs, etc., and also examples of carving bog oak in relief.

(*To be continued.*)

DRY-PLATE PHOTOGRAPHY.

By C. C. VEVERS.

XII.—MATERIALS FOR TONING, ETC.—WASHING—TONING—FIXING—ELIMINATION OF THE HYPO—WASHING MACHINES, BY CHEMICAL ACTION—TESTS FOR HYPO—VARIOUS TONING FORMULÆ.

FOR toning, fixing, and washing the prints, the following materials and chemicals should be obtained: One or two deep Porcelain Dishes, size about 10 inches by 8 inches, cost about 1s. 8d. each; 15 grain tube Chloride of Gold, 1s. 10d.; 1 oz. Acetate of Soda, 1d.; 1 oz. Bicarbonate of Soda, 1d.; 1lb. Hyposulphite of Soda, 2d.; *1 oz. Acetate of Lead, 2d.; *Washing apparatus; Distilled water; Three 20 oz. bottles; Blotting paper; Litmus paper.

One porcelain dish may be employed for both toning and fixing if it be well washed after each operation—especially the latter; but another dish will be necessary for washing. The sensitizing dish may be used for this purpose, but it is better if kept entirely for the silver bath. The amateur will find his porcelain dishes extremely useful, and as the cost is very low, he will not regret purchasing two, or even three of them.

The gold chloride being very deliquescent, is supplied in hermetically sealed glass tubes or bulbs, containing usually 15 grains of the salt. That manufactured by Johnson and Sons is recommended, as it is of better quality, and contains more pure gold (7 grains being guaranteed) than most other makes.

Blotting paper—specially prepared and chemically pure—for drying prints is sold by most dealers, but I have never, in the whole of my experience, found any ill effects arise from the use of ordinary white blotting paper if perfectly clean.

Now to prepare the toning and fixing solutions. A 15 oz. or 20 oz. stoppered bottle is thoroughly washed and 2 ozs. or 3 ozs. of distilled water poured into it, the tube of gold is then dropped into the bottle and broken with a glass rod. In this way every particle of the gold is secured. The broken glass will do no harm if it is not poured into the toning dish, but the label should be scraped off before putting the tube into the bottle. 1 oz. of acetate of soda is next weighed and dissolved in 12 ozs. or 13 ozs. distilled water, and poured into the bottle, which should then contain 15 ozs. of a bright yellow solution. The solution, which is given below in a synoptical form, is then tested with litmus paper and made *distinctly* alkaline by the addition of sodium bicarbonate—probably a drachm will be required for this purpose—and is then labelled :—

Gold, Stock Solution.

Chloride of Gold	15 grains
Acetate of Soda	1 oz.
Bicarbonate of Soda	about 1 drachm
Water (distilled)	15 oz.

This solution will keep several months if preserved from a strong light, which has the effect of reducing the gold and throwing it to the bottom in a black precipitate. One grain of gold will tone prints equivalent to one sheet of paper, so that the quantity of solution required can be easily calculated, as each ounce of the stock solution given above contains 1 grain of gold, and only requires diluting in the proportion of eight to one (8 ozs. water to 1 oz. stock solution) to be ready for use. The bottle containing this solution should be labelled "Toning Bath;" it must, of course, be perfectly clean, but need not be stoppered. The only other solution required is the hypo fixing bath, which is made thus :—

Fixing Solution.—For Prints.

Hyposulphite of Soda	4 ozs.
Water	1 pint

To each pint of this solution, in summer, and especially in hot weather, should be added 1 drachm ammonia ·880, which prevents the occurrence of blisters.

Toning should be conducted in a good, but non-actinic light, therefore it is advisable to wait until dark, when gaslight, which has no action on the sensitive paper, can be used. The prints are rolled picture side inwards, one round the other, so as to form a roll, which is held in the left hand. They are then unrolled singly, and after drawing them once or twice through the water to prevent their curling, are laid face down in a dish of clean water. When doing this, the water must not be splashed over the prints held in the left hand, or it will probably produce yellow stains. The hands should also be quite dry : perspiration produces greasy stains, which cause the print to tone unevenly.

When the whole of the prints have thus been immersed in the water, the bottom one is drawn from underneath and laid face upwards on the others; then the next is reversed in the same way, until the lot are laid face up in the dish. The water by this time will have turned the colour of London milk, caused by the free nitrate of silver being washed out of the paper. The free nitrate must be almost quite washed out before toning. This washing water is collected by the profession, and when the silver has been precipitated by common salt or hydrochloric acid, the residue is sold to the refiners ; but the amount of silver procured from an amateur's yearly washing is so minute as to be hardly worth the trouble of collecting. After the prints have been turned over, the water is poured off and the dish filled with a fresh supply ; the prints are again turned over one at once, the water again emptied off, and a fresh supply poured into the dish. This time the water should be only slightly milky. After standing a couple of minutes it is replaced by a fresh supply, and the prints are then ready for toning.

Cold weather has the effect of restraining the action of nearly all photographic chemicals, and in winter-time toning can be conducted with greater facility if the solution is slightly warmed ; it must not, however, be *hot*. When this is done, the fixing bath should also be aired. The easiest way of warming the solution is to immerse the two bottles (after removing the corks) in a pan of hot water.

The toning solution is poured into a clean porcelain dish, and a few prints—not more than half-a-dozen—are, after draining off the washing water, immersed one at once, face down, in the solution. When the bath is new its action sometimes is very rapid, and unless the prints are kept continually moving in the solution, they will tone unequally ; consequently, the beginner, until he has gained some experience, should only immerse a few prints in bath at first.

In the washing water the prints turn to a bright foxy-red colour ; in a few minutes after immersion in the toning solution they commence to change to a more agreeable shade, first assuming a brown tone, next a violet, and, if left long enough in the bath, a cold grey or black colour. The prints must be kept moving in the solution by turning them over and over as in the washing water, and rocking the dish from side to side like the developing dish ; to assist in this rocking movement a thin strip of wood may be laid on the bench under the middle of the dish.

It is difficult to explain on paper the exact tone the prints should reach before being removed to the washing water previous to fixing, the amateur must be guided by his own taste, remembering that the prints become greyer and "colder" in the hypo solution, and also look blacker when dry. The time required for toning in a bath of average strength is from ten to twenty-five minutes. As each print assumes the desired tone, it is removed to a dish containing clean water, where it remains until the whole batch is toned. Flat prints from over-exposed negatives, or weak ones from under-printing, tone very rapidly, and unless the bath is very slow (*i.e.*, weak) they never tone a rich chocolate colour, but quickly change from the red to an insipid grey tone. When the bath is new its action is so rapid that such prints often assume a mottled grey colour round the edges, while still red in the centre ; therefore, when th solution is new the dense prints should be toned

first. On the other hand, prints with much contrast, deeply printed, change colour slowly, yield a rich brown tone, but require very long immersion in the bath to produce a purple colour. Dark prints should be toned almost black, and if left in the fixing solution an increased length of time are greatly reduced, and often produce passable prints.

As each print is removed to the washing water, an untoned one can be taken from the other dish and immersed in the solution; thus as one is toned another takes its place, until all are finished and ready for fixing. If not exhausted, the toning solution is then returned to its bottle, and a memorandum made on the label as a guide to its strength; for example: "20 oz. bath" (2½ grains gold) "toned 1½ sheets," thus showing that a bath strong enough to tone 2½ sheets of paper, but only 1½ sheets having passed through it, still contains sufficient gold to tone (more or less) 1 sheet of paper. Of course, such a calculation cannot be exact, as a purple print is much richer in gold, and has, consequently, reduced more gold from the bath than has a print of a brown tone.

The fixing bath having been brought to the same temperature as the toning solution, it is poured into another dish; the prints are taken from the washing water and immersed in the hypo solution face downwards. As quickly as possible they must be separated by turning them over one at once, so as to allow the hypo to act on the whole surface of each print, both back and front, and prevent stains. Immediately the prints touch the solution they will turn slightly yellow like a half-toned print, but will quickly assume the tone they received in the gold bath, and as fixation proceeds will become lighter and greyer.

Although it is not necessary to keep the prints moving continually, as in the toning bath, they should be turned over singly several times, as air bubbles between the prints prevent perfect fixation. When the bath is new, 10 or 12 minutes' immersion is sufficient for a print of correct depth. By removing a weak print after 5 or more minutes' immersion, or leaving a dark one in the bath up to 30 minutes, inequality of printing can be corrected to some extent, although always at the sacrifice of agreeable and equal tones.

A bath containing 4 ozs. of hypo is strong enough to fix from 8 to 10 sheets of paper, so that after use it may be returned to the bottle, and a note made on the label similar to that on the toning solution bottle. Hyposulphite of soda, however, is very cheap, and it is always best to use a fresh solution for each batch of prints.

We now come to the most tedious part of the whole process—print washing. The prints, when removed from the fixing bath, are naturally impregnated with hypo, which, if not entirely removed slowly decomposes, liberates sulphur, and causes them to fade in a few weeks; and whether in large or small quantities, the hypo in the prints has the same effect, deterioration being only a matter of time. Look through any old photographic album and you will find many, if not most, of the photos therein in all stages of fadation: yellow patches appear, especially in the half-tones, and as time advances, these yellow places begin to disappear, and in very advanced cases finally leave a bit of dirty paper mottled with patches of a browner shade in place of a once possibly beautiful photograph. If exposed to daylight, such prints fade much more rapidly than if kept in a closed book. Nothing points out a careless photographer more than a show-case containing, say, two-year-old prints in an advanced state of hypo-measles and yellow fever—it shows slovenliness in two things: imperfect washing and a dreadful lack of "keeping up with the times." Everyone knows how frightful ladies' fashions two years behind time look in a case of photographs. But if the reader is a careful observer, he will have noticed that in an album of photos, while some, say, two or three years old, are badly smitten, others perhaps six or eight times as old, are in a comparatively fresh condition. What is the cause of this difference? Simply because the former have been insufficiently washed, while the more perfect prints have been freed from hypo, as much as it is possible to do. An albumen print cannot be made absolutely permanent, but properly toned, fixed and freed from hypo, it should last a lifetime.

There are two methods of removing hypo from the prints: 1st by prolonged washing, and, 2nd, by chemical action. The last method has only been introduced during the last few years, and it is not so well known as it deserves to be. I will, however, describe the older and slower method first, and also describe a few contrivances for mechanically washing the prints.

The prints are taken from the fixing bath and immersed in a deep dish containing clean water; the dish is placed under a tap and a stream of water allowed to flow down an indiarubber tube, which should reach the bottom of the dish so that the fresh water runs along the bottom of the dish and thus carries away the hypo, which, its specific gravity being heavier than water, sinks to the bottom. The prints should be turned over a few times, and each in succession brought under the force of water from the tap, care being taken that they are not torn when doing this. About every ten minutes, for, say, an hour, the dish should be entirely emptied and refilled so as to ensure a complete change of water. The necessity for this and the inefficient plan of leaving the water to run

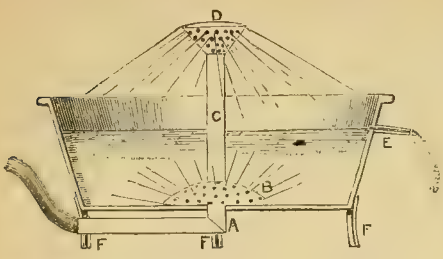


FIG. 62.—MUELLER'S WASHING MACHINE.

through the dish without an occasional emptying and refilling, is illustrated in a very convincing manner, in an experiment described by S. C. Ponting, in his "Photographic Difficulties" (1867).

A tray was filled with twelve pints of water, to which two ounces of ink had been added, and well mixed; water from a tap was then allowed to flow into it through an indiarubber tube at the rate of three pints a minute; not until three and a half hours had elapsed, and nearly eighty gallons of water used, was the colour of the ink entirely got rid of; and this, be it remembered, was without any prints to impede the flow of the water. There can be little doubt, therefore, that if the tray had been charged with a lot of prints, the water would not have been fully changed in three or four times the period, and unless the prints were moved, the probability is that the centre would scarcely be touched. This shows how difficult it is, by this contrivance, to secure an effectual cleansing of the print. The prints must remain in running water for at least four hours (the best plan is to leave them running all night), an occasional turning over and rinsing will greatly facilitate the washing.

This is the slowest and simplest method of print washing, but nearly all printers have a favourite way of expelling the hypo as rapidly as possible. Some lay the prints singly on a sheet of thick glass, and squeeze out the liquid with an indiarubber roller or "squeegee;" others employ a circular trough, and by directing the inflow against the side, cause the prints to rotate round the trough; others use alternate baths of hot and cold water—hot water certainly has the effect of very rapidly eliminating the hypo, but a sudden change of temperature is very conducive of blisters. I have found *warm* water, however, if carefully applied to the *backs* of the prints, very satisfactory. Prolonged soaking serves no good purpose, it merely leads to a loss of vigour and brilliancy in the prints, and possible discoloration from sulphur.

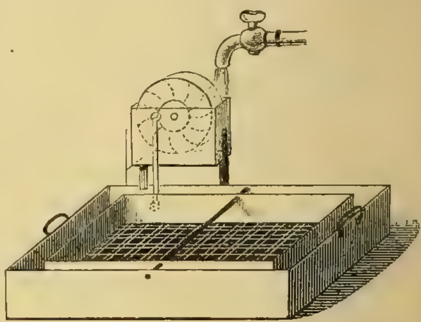


FIG. 66.—ENGLAND'S WATER WHEEL MACHINE.

Numerous mechanical contrivances have been invented for automatically keeping the prints in motion, remove any subsidence of hypo in solution, and periodically change the water. Many of these are the subjects of patents, others, equally effective and ingenious, are unpatented. Perhaps the most popular machine is the syphon washing trough: these can be purchased in porcelain, zinc and other materials. The trough is usually circular in shape, the syphon attached to the side, and a perforated false bottom about two inches above the real bottom. Its action is as follows: when the water reaches the bend of the syphon (which should be one or two inches from the top of the trough) the syphon commences to act and carries away the contaminated water, which, loaded with hypo, sinks to the bottom, thus practically removing the water fro· the bottom.

Mr. G. A. Carruthers in the *Journal Almanac*, 1886, describes a simple addition to such a trough which has the effect of keeping the prints in motion; it is illustrated in Fig. 60. It consists of a supply tube, A, B, C, connected by indiarubber tubing to the water tap. It passes under the trough, through the bottom, and is cut off flush with the upper surface of the perforated or false bottom, D. Messrs. Marion and Company sell a syphon trough, 14 inches diameter and 5 inches deep (Fig. 61) at 7s. 6d.; and 12s. and 20s. for larger sizes.

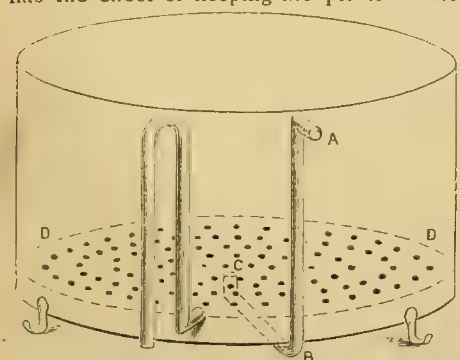


FIG. 60.—CARRUTHER'S ADDITION TO WASHING TROUGH.

The great disadvantage of these syphon washing machines is the difficulty of regulating the ingress to the egress of the water supply. If insufficient water be running in the syphon will drain the trough dry, while if a greater quantity enter the trough than can be discharged by the syphon, the excess runs over the edge, and probably carries a number of prints with it.

Dr. J. Max Mueller in this year's *American Annual* describes a capital washing machine, an illustration of which

is given in Fig. 62, as follows :—" Procure from any tin store a large pan, the upper diameter of which is, say, 18 inches, and let the tinsmith change this pan into a print-washing machine, which the diagram will best explain. D is a rose like the one on any watering-pot, only the holes for the water to come through are not on the top of the rose, but underneath, as indicated. This will direct streams of water downward and right on the prints floating in the water. C is a tin tube, about five-eighths inch in diameter, and soldered to D above and B below. Its height is such as to bring the rose 3 inches or 4 inches above the top of the pan. B is another rose soldered to the bottom of the pan, and with small holes punched through to force the water upward. A is a supply pipe, of such diameter as to allow common garden hose to be slipped tightly over it; F, F, F, are three iron legs to support the machine; E is the outlet pipe, which, however, may be of syphon form if desired. Now attach india-rubber tube to A, and the other end to the tap or spigot of bath tube, and turn on the water. This will be forced through B upward into the pan, and through D downward. The force of water, properly regulated, will fill the pan to E, and produce an ever-changing constant stream flowing through the pan. Wash the prints about two hours. The whole affair ought not to cost more than a dollar and half (6s. 3d.), and is effectual."

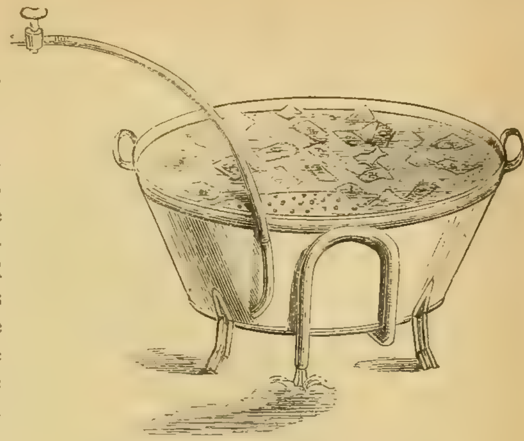


FIG. 61.—MARION'S SYPHON TROUGH.

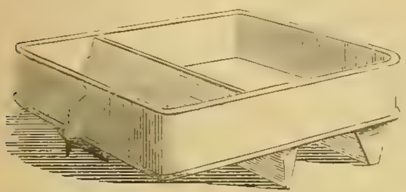


FIG. 63.—GODSTONE AUTOMATIC WASHING TRAY.

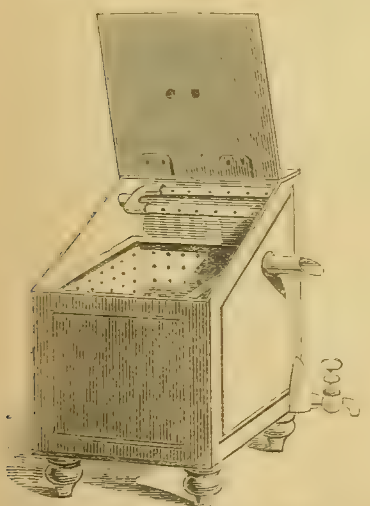


FIG. 65.—WASHING APPARATUS WITH PORCELAIN TROUGH.

A very ingenious and efficient machine is the "Godstone Automatic Washing Tray," Fig. 63. It is a self-acting rocking trough, which periodically discharges the water as often as desired, and "works equally well with one drop or thirty gallons of water per hour." It is a patented article, and is sold by most dealers in three sizes, the first two (either of which are large enough for an amateur's use) cost respectively 6s. 9d. and 9s.

Marion and Co. also supply another form of washing apparatus, which is very efficacious but rather high in price; the smallest size, measuring 15 inches by 18 inches by 19 inches, costs £2. Fig. 64 will give an idea of its action. A semi-circular perforated trough is enclosed in a wooden case, which is fitted with an ordinary overflow pipe and a tap for emptying the machine. The inflow enters from two pierced tubes which run across the machine, and are pierced and pivoted in such a manner that the shower of water falls at a proper angle to produce a swift rotary movement, causing the print to be continually moving round the cylindrical trough, and effecting the complete elimination of hypo in two hours, as has been certified by the public analyst of Brighton. Similar machines, but with porcelain troughs and japanned zinc case (Fig. 65), are offered at 50s. each.

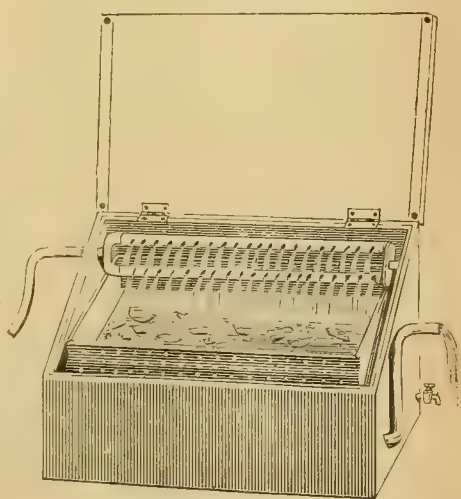


FIG. 64.—MARION'S WASHING APPARATUS.

I must not omit to mention an ingenious contrivance

of Mr. W. England's (Fig. 66). It consists of a trough about 24 inches by 18 inches by 8 inches deep, or any more convenient size, made of wood (pitched inside), zinc, or slate. Mr. England recommends the latter. Inside this trough is fitted a wooden frame about 5 inches deep, and rather smaller than the trough; this is pivoted on the centre to allow a rocking motion. The bottom of this frame is covered with gutta-percha strips ½ inch wide, laid along and across the trough, so as to form a trellis-work with ½ inch openings. A water-wheel 8 inches or 10 inches diameter, made of Willesden paper or zinc, is fixed in a small cistern, and fitted on one side of the trough. A crank connects the rocking frame to the edge of this wheel. A stream of water, playing on the wheel, works the crank, and rocks the inner frame containing the prints, while the water employed for turning the wheel is conducted, by means of a pipe, from the wheel case or cistern to the trough, and is utilized for washing the prints. This form of trough can, with advantage, be fitted with a syphon. I see no reason why Willesden four-ply paper should not be used for the bottom of the rocking-tray equally as well as gutta-percha.

The amateur, or if he does not possess a set of soldering tools, any local tinner should be able to make almost any of these machines at, probably, half the amount charged by the trade.

The chemical method of eliminating hypo is by the addition of salts of lead—nitrate or acetate—to the washing water. The following solution is prepared and labelled :—

Lead Stock Solution.

Acetate (or nitrate) of Lead . . .	1 oz.
Water	8 ozs.

After fixation, the prints are rinsed in a few changes of water, and then immersed in a bath of

Lead Stock Solution	1 oz.
Water	4 pints.

They must be kept moving in the above solution for about ten minutes, again washed in several changes of water, and the hypo will have been entirely removed. Lead added to ordinary water produces a precipitate of carbonate of lead, which has an affinity for the albumen on the prints, and should be dissolved by the addition of a few drops of acetic acid before the prints are placed in the bath.

Mr. J. R. Clemons, an American writer, recommends a very simple and rapid way of removing the hypo, which is certainly deserving of a trial. On removal from the fixing bath the prints are immersed in a saturated solution of alum for two or three minutes. They are then washed in several changes of water for five or ten minutes, and are finished. When alum washing is employed, the prints should be rather undertoned, as the alum has the effect of darkening the tone.

If any uncertainty exist as to the perfect elimination of the hypo, any of the following tests will immediately show if there be the slightest trace of hypo in the washing water. Sometimes, however, when no hypo is discernible in the washing water, a trace may still exist in the prints themselves; in this case, a spoiled print should be broken to a pulp, placed in a test tube, and the test applied.

Captain Abney's test is perhaps the simplest :—

Potassium Permanganate	1 grain.
Potassium Carbonate	10 grains
Water	20 ozs.

The permanganate gives the solution a pink tint; if a few drops are added to a pint of the washing water, it will turn *green* in the presence of hyposulphate of soda, but remain pink if hypo be absent.

Nitroprusside of soda is a very delicate test for hypo. This salt requires about 2½ parts of cold water for solution. The solution is decomposed in the sun's rays, the crystals being rhombic, and ruby in colour, and give a *violet* tint if hypo be present in the washing water.

The starch iodine test has come into favour lately. A few grains of powdered starch are boiled in about 3 drachms of distilled water to a clear solution. A flake of iodine is dissolved in the least possible quantity of alcohol, and one drop of the solution added to the starch solution. A dark blue compound of starch iodine results, and constitutes the test. About two drops are added to a little of the washing water; if hypo is absent, the blue colour remains, but if the water contains hypo the colour is discharged.

I have gone very deep into the subject of print washing, as I fear it is a part of photography which is treated very lightly by most writers and operators, and not with the importance and care it demands.

After being washed, the prints are dried between sheets of clean blotting paper, and are then ready for trimming and mounting. Should it be desired to keep them unmounted, any tendency to curl may be prevented by laying the print, when dry, face down on a clean, flat surface, and drawing it under a smooth edged ruler, or other suitable article, gradually raising the paper as it passes under the ruler.

I append formulæ for tungstate, borax, phosphate and lime toning baths, all of which are reliable :

Tungstate of Soda.

Chloride of Gold	15 grs.
Tungstate of Soda	5 drachms
Water	15 ozs.

To tone one sheet of paper, add 1 oz. of the above stock solution to 8 ozs. of boiling water, let cool and use.

Borax. No. 1

Chloride of Gold	15 grs.
Water	15 ozs.

No. 2

Borax	2 drachms
Hot Water	20 ozs.

To tone one sheet of paper, add 1 oz. No. 1 to 8 ozs. No. 2.

Phosphate of Soda.

Chloride of Gold	1 gr.
Phosphate of Soda	25 grs.
Water	8 ozs.

Chloride of Lime.

Chloride of Gold	1 gr.
Whiting	20 grs.
Sat. Sol. Chloride of Lime . .	1 min. (drop)
Hot Water	8 ozs.

Trimming and finishing the print must be the subject of the next, and last, paper.

(*To be continued.*)

MODEL ENGINE-MAKING.

By JOHN POCOCK.

XI.—LOCOMOTIVE WITH OSCILLATING CYLINDERS.

IN this article I shall describe the making of a locomotive with oscillating cylinders. I trust that my readers will not despise, this, the most humble form of locomotive engine, for there is plenty of room for careful work over it; and it may be safely affirmed that any one who can turn out working models of this and the other engines already described in these papers, need not fear to take in hand the more complicated slide-valve locomotives.

The castings for the engine now in question, I obtained from Messrs. Lucas and Davis, of *Charles Street, Hatton Garden.* The price of the set is 6s. 6d., and they comprise the parts shown in Figs. 90 to 104, namely, bed-plate, boiler-tube, two boiler-ends, chimney tube and top, steam dome, two number-plates, two driving-wheels, two small wheels, two cylinder-blocks (cast in one piece), two cylinder-tubes and covers, two buffers (cast in one piece), and steam-tap, whistle, and gauge-tap—these last three being also cast together.

An engine of this class can very well be made without any castings except for the wheels; in that case, the bed-plate is cut out of stout brass and turned down as shown by the dotted lines in Fig. 105. Steam-blocks are soldered on and connected by a steam-pipe, into the centre of which the steam-pipe from the boiler is soldered. A prettier model, however, and one that will prove in every way more satisfactory will be turned out if the proper castings are purchased.

The first thing to be done is of course the filing up of the separate parts; and we will commence with the bed-plate. This should be filed up bright all over—the grooves in the foot-plate being left as cast or filed out smooth with a triangular file, according to taste. The steam-blocks on each side must be filed smooth, flat, and perfectly square with the top of the bed-plate. The four wheels must be turned up. These present no difficulty, only it must be remembered that each pair must be of exactly the same outside diameter, otherwise the engine will not run straight without rails. When the wheels have been turned, the bed-plate may be bored for the axles. The position of the bearings in the lugs cast for them on the underside of the bed-plate may easily be found in the following manner:—

Make a full-sized drawing of one side of the bed-plate, and (parallel with the top of the bed-plate) draw a line rather more than the diameter of the small wheels below the bed-plate; now draw two circles to represent the wheels, just touching with their circumference the lower parallel line, and the centres of these circles will mark the positions for the axle-bearings. The axles will be made of steel rather over $\frac{1}{8}$ of an inch in diameter, and the wheels may be either keyed on or screwed—the latter method is the more convenient, as the wheels can then be easily taken off when required. The carriage should at this point be put together and tested, by running it on a smooth and level surface to see if it runs straight.

The boiler may now be put together. The top must be soldered on to the funnel tube, and this part may then be put into the lathe and polished with emery-paper; the steam-dome must be turned up and the under side filed to fit the curve of the boiler. Two holes must be drilled exactly opposite to each other at one end of the boiler-tube to take the funnel, which may be at once soldered in. If the steam-pipe is to be inserted into the dome, a hole $\frac{1}{4}$ inch in diameter must be made in the boiler, and another $\frac{3}{16}$ inch in diameter in the centre of the dome, to receive the steam-pipe. These holes must, of course, be made before the dome is soldered on; and when this is done care must be taken to have the dome in a line with the funnel. Between the dome and the end of the boiler-tube let there be soldered on to the inside of the tube a piece of brass as thick as the tube itself, or somewhat thicker, and half-an-inch or so square, then bore and tap the part thus lined for a quarter-inch screw. This is the man-hole, and although the size given here is smaller than usual, the engine will have a neater appearance; the small man-hole is more easily kept steam-tight, and with a short length of

india-rubber tubing to act as a syphon, there need be no difficulty about filling the boiler.

The ends of the boiler must next be filed up and soldered on. A little solder should be run round the flange of each end-piece and round each end of the boiler-tube itself. Now stand the boiler-tube in position upon the end to be soldered, and a soldering iron or blow-pipe flame run round the joint will unite the two parts.

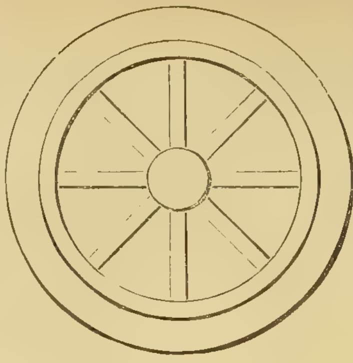


FIG. 99.—FRONT WHEEL.

The cylinder-tubes will next be ground out smooth, as described in my second article in Vol. V., page 279, of this Magazine, two pieces of sheet brass must be filed up to fit into the cylinder ends, and one soldered into one end of each.

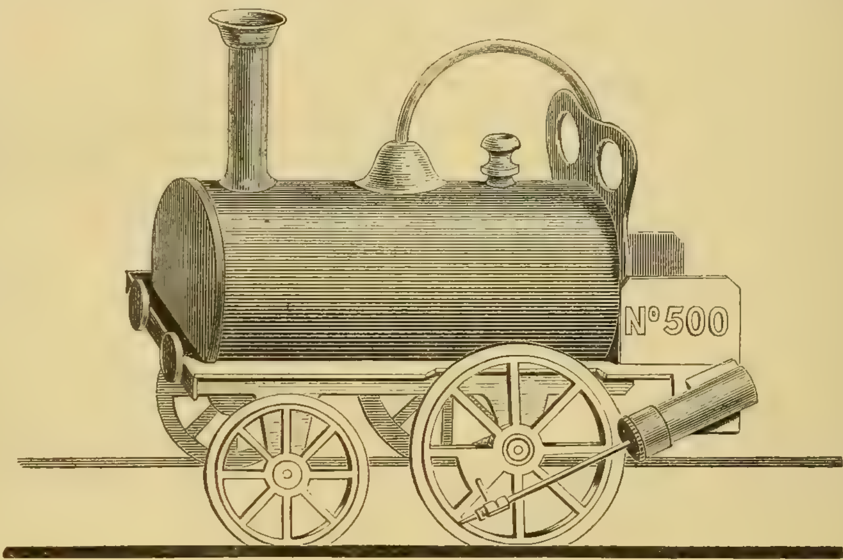


FIG. 107.—FINISHED ENGINE.

*** Figs. 90—94 inclusive, and Figs. 105, 106, and 107 are half size : Figs. 95—104 inclusive, and Figs. 108—111 inclusive, are full size.

The steam-blocks must then be sawn apart and the groove in each block filed out to fit the cylinder-tubes, which must then be soldered to the blocks. A hole $\frac{1}{16}$ of an inch diameter is to be drilled through the steam-block into the cylinder close to its lower end, and about $\frac{5}{16}$ of an inch above it, a pin made of steel wire rather over $\frac{1}{16}$ of an inch in diameter and $\frac{3}{4}$ of an inch in length, is to be screwed into the cylinder face. This pin must also be screwed at its free end to take a small nut.

The cylinder covers must be turned up, and should, when finished, fit stiffly over the tops of the cylinders, the hole for the piston-rod being of course bored while the cover remains in the lathe. The piston should be turned up from a piece of brass rod, and bored and tapped for the piston rods; the latter are made of steel $\frac{1}{16}$ to $\frac{3}{32}$ of an inch in diameter and 2 inches in length. Heads for the piston-rods are turned up from $\frac{1}{4}$ inch brass rod to the shape shown in Fig. 109, a hole being drilled through each to take the driving-pins of the driving-wheels.

The driving-pins are made of pieces of steel wire the same size as the piston-rods, and about half-an-inch long. They must be screwed into the solid part of the driving-wheels, at a distance of half the piston-stroke from the centre of the wheels.

The steam-ways may now be made. It will be found that underneath the rear end of the bed-plate casting, the metal is thick enough to allow of the steam-ways being bored in it. A hole $\frac{1}{16}$ of an inch in diameter is first bored from one steam-block half-way through, and a similar hole from the other steam-block joins it. These steam-ways should be bored as low down as they safely can. The hole for the steam-pipe is made underneath, if the engine is to be fitted up as shown in the drawing, or it may be made from the top, and the steam-pipe

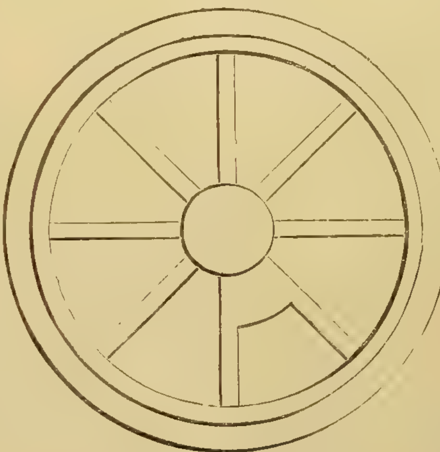


FIG. 98.—DRIVING WHEEL.

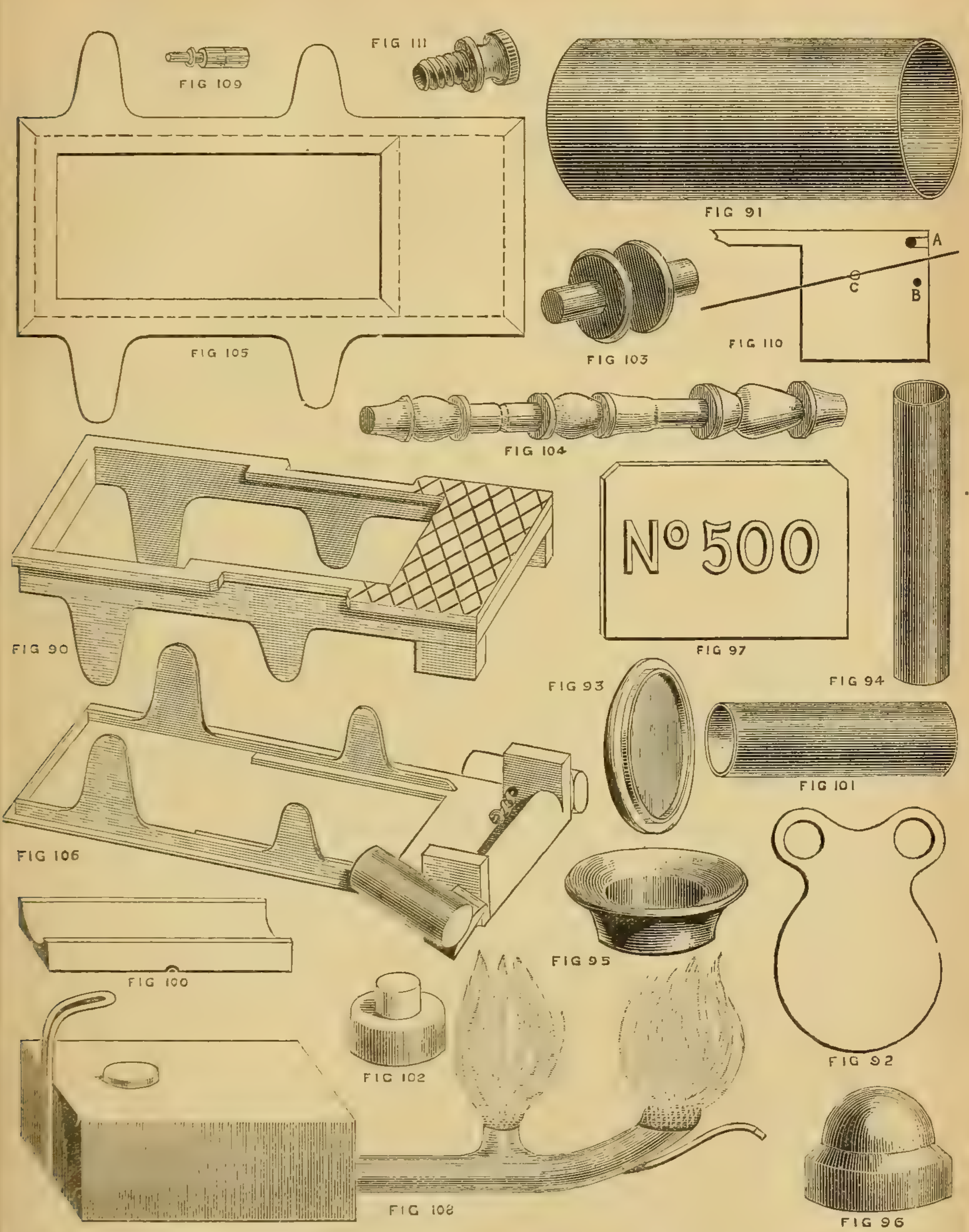


FIG. 90.—CAST FRAME. FIG. 91.—BOILER TUBE. FIG. 92.—BOILER END. FIG. 93.—BOILER END. FIG. 94.—CHIMNEY. FIG. 95.—CHIMNEY TOP. FIG. 96.—STEAM DOME. FIG. 97.—NUMBER PLATE. FIG. 100.—CYLINDER BLOCKS. FIG. 101.—CYLINDER TUBE. FIG. 102.—CYLINDER COVER. FIG. 103.—BUFFERS. FIG. 104.—STEAM AND GAUGE TAPS AND STEAM WHISTLE. FIG. 105.—ALTERNATIVE FRAME. FIG. 106.—UNDER SIDE OF FRAME WITH CYLINDERS FITTED. FIG. 108.—LAMP. FIG. 109.—PISTON ROD HEAD. FIG. 110.—STEAM BLOCK—A, Exhaust; B, Steam Way; C, Hole for Cylinder. FIG. 111.—MAN-HOLE SCREW.

brought to it from the end of the boiler instead of coming from the dome at the top. A line must now be drawn through the centre of the steam-way and the driving-pin, with the driving-wheel in the position it would occupy with the piston at half-stroke. Upon this line should be drilled the hole for the cylinder-pin, of course, at the same distance from the steam-way as the pin itself is from the steam-port in the cylinder. Grooves are cut in the steam-blocks for the exhaust steam, as shown in Fig. 110. To find the position of the exhaust, draw a line running through the centres of cylinder-bearing and driving-wheel, and the exhaust will be the same distance above such a line as the steam-way is below it.

The cylinder face must be ground to the steam-block with a little fine emery and oil, the cylinder being worked backwards and forwards as it will ultimately work under steam, and the surfaces may then be washed and finished off by working with a little putty powder in place of the emery. The cylinder faces are kept against the steam-blocks, by means of spiral springs and nuts, as explained in the article on an Oscillating-Cylinder Engine, in Vol. V., page 371, of this Magazine. One of these springs is seen in Fig. 106.

The engine may now be fitted together, the steam-pipe being soldered into the boiler and into the hole made for it in the bed-plate. If a safety valve is to be added to the boiler, a steam tap may also be added, but if no safety valve is put in, it is better to connect the boiler direct with the steam-ways.

Fig. 111 shows the screw for the man-hole of boiler; a little hemp or a leather washer will make it steam-tight. The number-plates have each a flange by which they are to be soldered on.

In putting on the driving-wheels be careful to see that when the driving-pin of one wheel is at its highest point, that of the other wheel is at its lowest. If the wheels are screwed on to the axles, it may be necessary to file a flat upon one of them, and drive a wedge in when the wheels are in the correct position. With only one wheel of each pair to screw on, the wheels will still be easily taken off should it be necessary at any time to do so.

A small slip of mahogany should be screwed on to the front of the engine frame, and the buffers having been turned up and separated, they are fastened into two holes in the wood.

Fig. 108 shows the lamp; this is made as follows: Make first a tin box about 2 by $1\frac{1}{2}$ by 1 inch; for material a piece of an empty meat-tin will do as well as anything. Then a piece of $\frac{3}{8}$ inch brass tubing, $2\frac{3}{4}$ inches long, is bent as shown in the illustration, and a short piece half-an-inch long is soldered into it, about an inch from the curved end. This branched tube is now soldered into the tin box, and to the other end of the box a hook made of a piece of wire doubled and bent is fastened, by which the lamp may be hooked on to the foot-plate of the engine, while another piece of wire soldered to the front of the lamp rests upon the axle of the front wheels. The hole in the top of the lamp, for filling, may be closed either with a cork or a screw.

A small pinhole should be made in the top of the lamp to allow air to enter as the spirit is burnt away.

I say nothing at present about Fig. 104, because steam-taps, whistles, etc., will be described in a separate article, and are not essential to this engine.

(*To be continued.*)

UPHOLSTERY AT HOME.

By DAVID ADAMSON.

IV.—UPHOLSTERING A CHAIR WITH SINGLE STUFFING AND STITCHED ROLL.

THE two modes of upholstering chairs already described, viz., with pin stuffing and hay roll, though useful in their way, are not generally adopted for ordinary purposes, and we may now consider the usual method, or I should rather say methods, for there are several, employed in stuffing the seat of a small chair.

Perhaps it will be as well to explain what is meant by "small chair" when the term is technically used as in the present instance, for it does not necessarily imply that the chair is only a little one. Thus the chairs illustrated in Part 3 of this series of articles though they are, according to modern ideas, large in size, are called in trade parlance "small chairs." It simply means that chairs so designated are of the usual height for sitting at table, as distinguished from low occasional chairs, easy-chairs, arm-chairs, etc.; in fact, the "small chair" can be more easily explained by stating what it is not than by explaining exactly what it is. Possibly, when I say that the ordinary upholsterer's suite consists of a couch, two easy, and six "*small chairs*," a definition sufficiently accurate for present purposes is given. Why the six should by implication not be easy, too, that is, as comfortable as the two easy-chairs, is a mystery, and not creditable to their character. What have the small chairs done, poor things, that such an invidious distinction should be drawn between them and their larger companions, which in many cases are easy only in name? The small chairs, too, should be easy, that is to say, comfortable to sit on; if they are not, then there is something wrong about them.

The very essence of a chair of any kind is that it should afford a rest to the human frame, and if it fails in that respect, from whatever cause, never mind how pretty it may look to the eye, it is not satisfactory, simply because it does not fulfil its intention ; nor can it be said that such a chair will long gratify even the eye, for it is clearly not a genuine chair: it is a sham, and therefore offensive. That projecting bit of carving may be very good, and in another place might excite admiration, but placed where it is in the centre of the top rail, just where it will make itself unpleasantly felt by your spine when you lean back—well, its position does not commend itself. Again, that beautifully rounded hard seat, convex not concave, which so many seem to consider the acme of the upholsterer's art, is scarcely what any one possessing a very slight acquaintance with anatomy could regard as appropriate.

A stuffed cannon ball raised high enough from the ground would be almost as comfortable as, and infinitely more durable than, some of the abominations called by courtesy chairs : things that are doubtless often sold, but seldom used for the very sufficient reason that they don't last long enough to be sat upon much. There is a yarn—forgive the word—for I live within five miles of the sea, and it seems a natural one, though authentic narrative might sound better, about a purchaser of a five or six guinea suite of the aformentioned nine articles, "handsomely carved solid walnut frames [whoever heard of veneered or hollow frames] richly upholstered in silk rep or tapestry."

Within a few days of the precious bargain being delivered, the grass-green purchaser called on the seller to complain that all the chairs had broken or come to pieces. Of course, the seller could not account for such a mishap, and was unable to give any explanation or suggestion as to its cause. How could he imagine that his customer had been so foolish as to think that the things were to be sat upon. The purchaser had, though, and fancying they might be used, had actually attempted to sit on the chairs. The result was, as stated, and the seller had no longer any doubt why the things had not lasted longer. I heard this story first when a boy many years ago, and again last week in London, with trifling variations.

It is well known to those in the furniture trade, but it may be new to some others for whose benefit it is given here. If you want to know whether such a thing ever happened, all I can say is that I have heard several names mentioned in connection with it, but I don't feel free to give them on mere hearsay. My own notion is that the event occurred some thousand years or so ago, and even at that remote age, not in England, oh, dear no, but in Weissnichtwo, a place familiar, though its locality is rather indefinite, to the present generation as the residence of Professor Teufelsdröckh, whose name is associated with Carlyle's "Sartor Resartus." If ever you go there, my friend, make enquiries on the spot, and you will no doubt be rewarded by obtaining as much reliable information as your intelligence and thirst after knowledge entitle you to. Meanwhile, the practical stuffing of chair seats may more profitably engage our attention.

The most casual observer can hardly have failed to notice that seats of ordinary chairs, such as we are now considering, whether for drawing-room, dining-room, library, or any other use, are either plain or buttoned, and with or without springs. Each kind has advantages of its own, and the different arrangements of upholstering them will be duly mentioned, in order that the worker may choose for himself whichever suits him best. All things being taken into account the plain seat—that is, without buttons—is perhaps the most serviceable, as it certainly is the most suitable, for coverings of velvet, or any fabric which shows a pattern or design. The folds necessary in a buttoned seat are sure to destroy the uniformity of this, besides which, dust is very apt to accumulate in them. Plain seats without springs are now the favourites, and I think we may take it for granted that they are the best, for, after all, it hardly accords with one's ideas of fitness that a series of small hemispheres should be the natural thing to sit down on. Nor is a too yielding substance so comfortable for an ordinary seat.

A properly-stuffed small chair is soft enough, and should possess sufficient elasticity without metal springs. This, however, is to a great extent a matter of personal taste, and though I don't like either springs or buttons in a chair seat, complete instructions for forming both will be given in order that the wants of all may be satisfied. The present article will deal with a plain seat, with what is known as single stuffing, to distinguish it from the ordinary or double stuffing generally used in good class work. Though single stuffing is not so good as the other, still in capable hands a very serviceable seat may be made, and being comparatively easy, it is very suitable for amateur upholstery. When covered, it looks exactly the same as a seat with two stuffings. Though upholstering old chairs will probably be the chief work for the upholsterer at home, it may be fairly assumed that some may wish to upholster new frames, so it will be convenient to suppose one of such is to be worked on.

In choosing frames, it is better to select those with what are known as screws, or close instead of open braces. The braces are the pieces of wood which will be found in the corners, inside the seat frame of

any ordinary dining or drawing-room small chair. They serve to bind the different parts of the wood work together, and generally to give increased strength to the frame. Although it cannot be said that no common, badly-made frame is close or screw braced, it is not customary for such to be the case, but it will seldom be found that a really well-made chair has open braces. As a rule, a chair with open braces should be regarded by those inexperienced in such matters with caution, and screw braces be preferred. The latter, though more costly, are well worth the extra expense. The two kinds are so well known to any upholsterer, that it seems almost unnecessary to give the illustrations showing the difference between them.

It is, however, better, perhaps, to err by giving what may be superfluous explanation than to be deficient, and I think Figs. 16 and 17 will enable any one who does not already know the difference to distinguish between the two kinds. It sometimes happens that a chair has two corners, usually the back, close, and the other two open braced. This is done for cheapness, and perhaps it is only fair to say that many upholsterers consider open braced quite as good as the others, if the frame be well made. Possibly they may be, but I am one of those who prefer the screw braces, and it may certainly be said that the amateur is more likely to be disappointed in his expectation of getting a good chair with open braces than if he selected a frame with close braces. The latter actually *bind* the parts of the frame together, the former merely tend to keep the joints rigid, and, unless tightly fitted, might almost as well be away. If the frame is an expensive one, it is hardly worth while upholstering with one stuffing only. On a new frame, it will generally be found that the top edges all round are square or sharp, as in Fig. 18.

The first thing to be done is to bevel off the top outer edge, as shown in Fig. 19. The width of the bevel being about or little over ⅛ inch, just sufficient, in fact, to allow the head of the tack driven at right angles into it, to lie flat and not project over it. A rasp is convenient and generally used to remove the sharp edge as it does so easily and with sufficient finish. When this has been done, the chair is webbed in the usual way, three or four strands each way being fixed, according to the size of the seat, as directed in Chap. 3. In theory, any number of strands of webbing may be used, but in practice it is not well to have an excessive quantity, or the seat is apt to be too rigid.

The canvas is then fixed in the same way as on the other chairs described, the proper place for the tacks being about the centre of the top rails of the frame, at the same distance from each other as in a pin-stuffed seat. Now measure the distance between the two uprights of the back on the back rail of the seat, and cut a piece of any wood about 1 to 1½ inch square a little shorter, say ¼ inch. This piece of wood should be bevelled off on one side as per section in Fig. 20, and fastened down to the back rail with three or four nails—glue will not do—the bevelled side being towards the front. Of course, if the back of the seat rail describes a curve, this piece of wood must be shaped to it on the outside at least. The inside does not matter.

Many chairs are upholstered without this piece of wood, which, however, may be used with advantage as it stiffens the back edge of the upholstery considerably and has no disadvantages to render it objectionable. The reason it should be cut a trifle shorter than the distance between the upright rails of back is, that were it to fit tightly against these, an unpleasant creaking might be caused by its ends working against them or rather by them working against its ends, when any one leaning against the back moved. With a little space between, just enough to prevent touching is all that is necessary, none of the creaking sometimes found fault with will occur. If, however, a wider opening is left, it does not matter, or, if preferred, this rail may be omitted altogether, and the back edge finished off in the same way as the sides and front.

The foundation is now ready for the hair or whatever stuffing material is decided on. It is laid exactly in the same way as if the seat were to be pin-stuffed, but more of it will be required. It is somewhat risky to give quantities when one has not seen the chair to be stuffed, but in order to give some idea, 1¾ lbs. hair may be stated as approximate for an ordinary-sized dining-room chair. Much will, however, depend on the degree of hardness and thickness of seat required, as well as, to some extent, on the skill of the upholsterer. The hair should be worked in more firmly than was necessary in the case of pin-stuffing, for it will be remembered that this had only a slightly raised stuffing, the edge being brought down to the level of the frame by a gradual slope, as shown in section, Fig. 21.

In the kind of seat we are now considering the stuffing rises abruptly from the rail of the chair, and were it too loosely filled in it would be found that by and bye the upper part of the seat would overhang the woodwork, as in Fig. 22, instead of remaining in its original and proper condition, viz., Fig. 23. Of course, however well the stuffing may be done, the pressure of use has a tendency to cause distension or bulging out at the sides, and this is more the case in the kind of seat now described than in those which will be named later on. Everything, however, depends on the skill and care bestowed by the upholsterer.

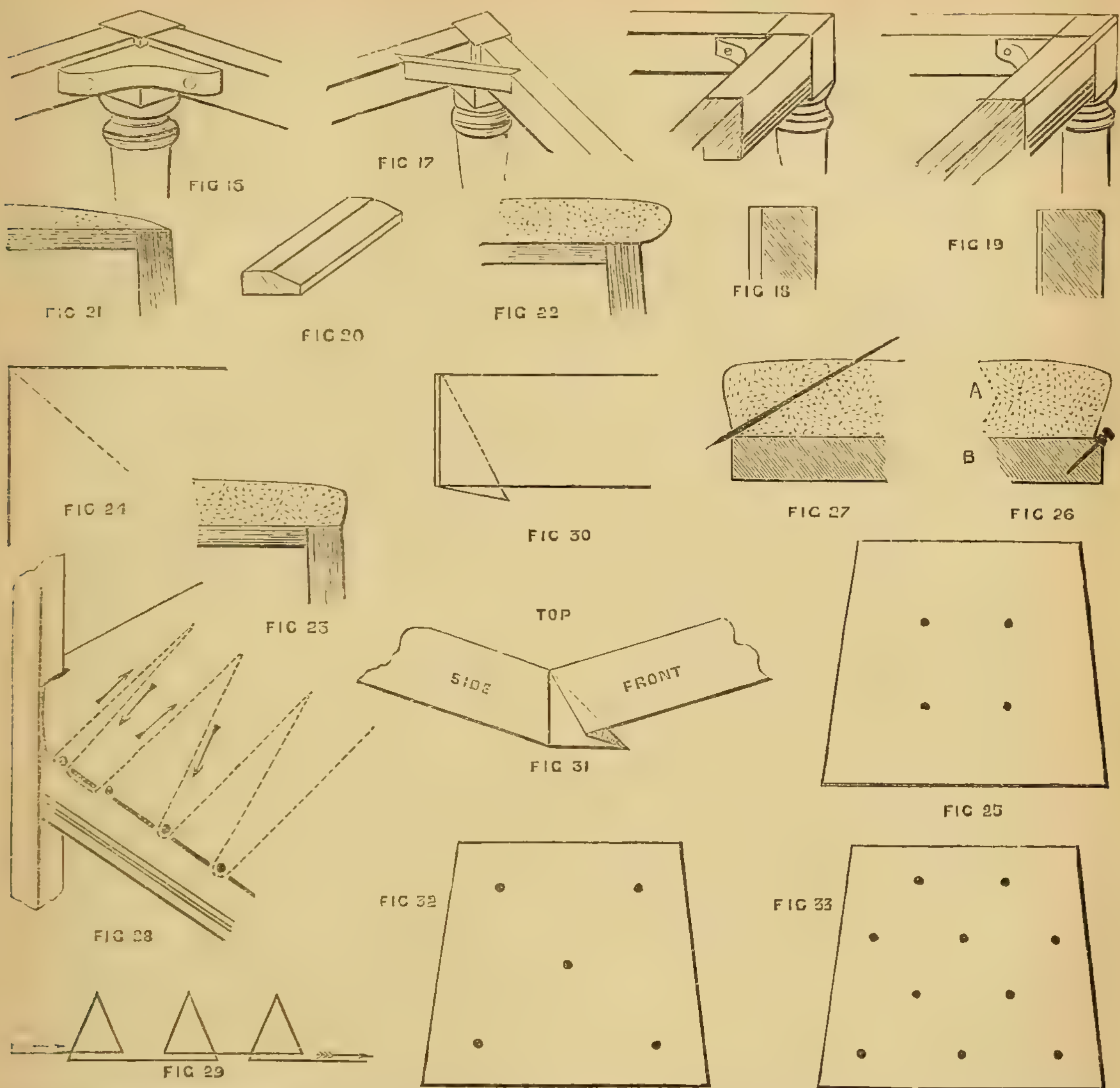


FIG. 16.—SCREW OR CLOSE BRACE. FIG. 17.—OPEN BRACE. FIG. 18.—NEW FRAME. FIG. 19.—FRAME WITH EDGE RASPED. FIG. 20.—PIECE OF WOOD CUT TO GO ON BACK OF SEAT. FIG. 21.—SECTION OF PIN-STUFFED SEAT. FIG. 22.—SECTION OF SEAT AFTER USE. FIG. 23.—SECTION OF SEAT IN PROPER CONDITION. FIG. 24.—SCRIM WITH DOTTED LINE SHOWING DIRECTION OF CUT FOR BACK LEG. FIG. 25.—CHAIR SEAT SHOWING POSITION OF TIES. FIG. 26.—POSITION OF TACK FASTENING DOWN SCRIM—A, Stuffing; B, Wood. FIG. 27.—NEEDLE INSERTED FOR BACK-STITCH. FIG. 28.—DIAGRAM SHOWING COURSE OF NEEDLE IN BACK-STITCHING. FIG. 29.—COURSE OF TWINE IN BLIND STITCH. FIG. 30.—FRONT OF SEAT SHOWING FOLD OF COVERING AT LEFT-HAND CORNER. FIG. 31.—COVERING SHOWING FOLD ON LEFT CORNER. FIG. 32.—SEAT WITH FIVE BUTTONS. FIG. 33.—SEAT WITH TEN BUTTONS.

When the hair has been well and evenly worked in, the scrim may be laid. Tack it down temporarily only at first to the outside of the frame all round. Three tacks to each of the side rails, and the same number for the back and front will be sufficient. As the scrim will have to be cut to fit it to the back legs, sufficient space should be left between the tacks nearest these to allow of this being done. Were a tack driven in close to the back legs, or within, say, a couple of inches of them, either at the sides or behind, the scrim could not so well be fitted. The way to do this is to cut from the corner of the scrim to the inner corner of the back leg which fits into the slit thus made, the superfluous stuff being turned in. Cutting the scrim is very simple, though not so easily described. Perhaps the best way will be to refer to Fig. 24, which shows the cut, and will prevent any misapprehension as to whether a piece should be cut out for the back legs. By turning the scrim over towards the opposite front corner, no difficulty will

be found in making the cut exactly as required. The pointed pieces should be turned in and not cut away; then on each side of the frame and close to the leg tack the scrim so that it may be evenly held down, still, however, only temporarily. The scrim being in its proper position, though not permanently fastened to the frame, it should be tied down in four places, which are approximately shown by the dots in Fig. 25. Their exact position is not important, as they are only temporary, and serve merely to keep the stuffing comparatively flat and even during the subsequent operations.

The ties, as they are called, are made by running a straight needle, threaded with a piece of string, through the seat from the top and tying the two ends together when they have been pulled sufficiently to flatten the seat and reduce its convexity.

The next thing to be done is to trim the scrim all round the chair, by cutting away any surplus or uneven parts. It should be cut to leave a fulness of about ¾ inch which will be plenty to allow for turning in. A little more hair will now have to be worked under, in order to give the required stiffness to the edge, which, it will be remembered, is raised above the frame, not tapered off as in the case of pin-stuffing.

To get the hair in, remove one of the temporary tacks holding the scrim, and push a little hair up. It does not matter at which part of the frame this work is begun; but if the sides are done first, it will be better to work towards the back; if the front, start at the centre. When it is judged that sufficient hair has been pushed in at any place, turn the scrim in and tack down permanently to the small bevelled edge already referred to—that is to say, the heads of the tacks must be on the bevel which has been prepared for them. Fig. 26 showing direction in which the tack is driven will, I think, make this clear. The tacks should be inserted about one inch apart. The next temporary tack is removed, hair worked in, and scrim fastened down in a similar manner till the seat is done. None of these tacks should, however, be driven quite home at present, though it is not necessary to leave much of them projecting. It will be quite sufficient if the space is large enough to allow of a piece of string going under each end and being covered and held by the head when hammered in completely. Much care will be required in putting in the hair at the edge, to get it regularly placed and distributed. Lumpiness should be avoided. Attention to this is much more important than to the quantity as the only effect a little more or less hair will have will be to make the seat harder or softer accordingly. The same remark also applies, in a general way, to the tension of the scrim, as the tighter it is pulled the harder will be the seat, as the stuffing will be more or less compressed. For ordinary chairs, the height of the stuffing above the top of the wood may be about one and a half inch when finished.

We now come to one of the most important operations in upholstery—viz., the stitching of the edge, which is stiffened and the stuffing held in its place. The principal stitch for this purpose is that known as the tack stitch to distinguish it from the blind stitch. In common work the latter alone is occasionally employed, but the result is not satisfactory, as the seat, unless very thin, soon becomes baggy at the sides and front, so it is better always to tack-stitch first. This stitch is so called because the twine used to make it goes under the heads of the tacks used to fasten down the scrim—these, it will be remembered, were to be left projecting a little when tacking the scrim.

To make the stitch, a needle, straight, and 6 inches or 8 inches long, threaded with some 3 yards or so of twine, will be required. The following is the mode of procedure, starting on the left-hand side of the chair: Close to the tack nearest the back leg, and as nearly as may be to the edge of the scrim where it joins the frame, insert the needle and push it through the stuffing in a slanting direction (see Fig. 27), so that it comes out on the top of the seat 3 inches or 4 inches from the edge.

Now a practical upholsterer, instead of drawing the needle right out of the seat and turning it round so that the point re-enters, may and does save much time by simply drawing the needle through till the eye, and consequently the string, are well through, and then pushing it backwards. (I fancy I have omitted to say that the eye of an upholsterer's needle is usually not at its extreme end, but a short distance from it, and both ends are pointed.) The novice, however, will probably find this movement somewhat awkward to accomplish with facility, and it will be easier to draw the needle out completely. He won't be able, perhaps, to work so quickly, but the result will be more regular stitching. The needle, whichever end is foremost, must be put in in exactly the same spot it came out of, for the stitch must only include the stuffing and not the scrim. It will not do for the needle to come up through one mesh and be put down through another, as were it to, the scrim would be pulled down when the twine is drawn tight; in fact, the twine should not show at all on the top, the only trace there of the tack stitch having been made being the slightly increased size of the mesh through which the needle has passed. In bringing the needle up from the side to the top it penetrated the stuffing, and as the object of the tack stitch is to form, as it were, a roll, or to bind the stuffing material together at the edge of the seat and to keep it down to the wood, it will readily be understood that were

the needle to go back in the way it came very little stuffing would be included in the loop formed by the string. In order to get as much as possible held by it at each stitch, the needle on being put in at the top should be pushed along just under the scrim and above the stuffing—or, in other words, between these two materials. A slight pressure downwards when the edge is reached, will cause the hair or other stuffing to give sufficiently to allow of the needle, point or head, as the case may be, being pushed out just above the wood, near the tack, but on the other side of it where the stitch began. This is the theory of tack stitching, but, of course, in practice the string does not go so absolutely between the scrim and the stuffing as to take up every particle of the latter. The needle and string being brought through, tie the loose end round the string from the exit hole to form a noose and draw fairly tight, catching it under the head of the tack. Re-insert the needle on the left-hand side of, and near to, the next tack, work through the top and downwards as before, bringing it out on the left-hand of the tack—the third from the back. The tack stitching is now fairly started, and to continue it round the chair insert needle at *right* hand of each tack, under the head of which the string should catch, and bring it out at the left of the next one.

This sounds rather complicated, but in reality the stitch is very simple, and to make it more easily understood, Fig. 28 is given. I feel, however, that a little practical ocular demonstration would be better than any amount of written description. In Fig. 28 the dotted lines show the course of the twine or needle, and the large dots the heads of the tacks. In order to ensure the stitches being drawn equally tight, it is necessary, or at all events advisable, to keep a good hold on the string with the left hand, and work the needle with the right, not letting go with the left in drawing taut till the next succeeding stitch can be caught. I have said that the string is to be drawn under each tack; and this, though perhaps a tedious course, will be found at first always a safe one. Experience alone will teach when the twine may be carried under alternate tacks without detriment to the work, though one omitted here and there will not matter. Much will depend on the closeness of the tacks to each other, and various circumstances which it is not possible to consider in giving general instructions such as those forming the present series of articles. The most that can be done without extending them to an undue length, is to give the standard methods adopted—or I should rather say, a standard for each of the necessary operations, as there are frequently different ways of obtaining the desired result in upholstery as well as in other crafts. What is one man's meat is poison to another; and I by no means wish it to be understood that, though space forbids more than one method to be stated in these pages, there are none other, and in the opinion, maybe, of some, better ways of going to work. In the cases where there are several, I do not necessarily give the one that occurs to me first, or that may in the hands of a skilful upholsterer be the best. Each is given with due regard, not only to efficiency, but to the class of men—viz., unskilled amateurs in upholstery, for whom this magazine is intended. I am induced to make these remarks, as thanks to the kindly notice of "Upholstery at Home," in the pages of a trade contemporary, these articles are likely to be largely read by those for whom they are not primarily, nor indeed in any sense, intended. No pretence is made at treating the subject exhaustively; and I trust that any professional upholsterers who may read these lines will not forget this. No one knows better than I do the shortcomings of these instructions; but, to reassure the amateur, I may say that each paper as it is written is given to experienced practical upholsterers on whom I can rely, in case my own judgment may be at fault, for their criticism, and, if required, for subsequent alteration. For defects of expression, which to the uninitiated may not clearly convey the meaning, I alone am at fault. The methods given are right, even if the language is not definite enough; therefore, possibly these articles may not be without some benefit to the younger members of the upholstery craft, though for them their foreman, or whoever superintends them, will be their best teacher and *vade mecum;* and if he prefer some other method to that which is here given for any piece of work, no doubt he will have good reasons, which ought to be respected, for his preference.

Pardon this short digression, my amateur friend, as I am sure you will in the goodness of your heart, when with me you consider that, were it not for the willingness of experts in other crafts to impart their knowledge, we should know very little beyond our own narrow grooves, and be deprived of many a valuable source of recreation and domestic economy. After all, are not the best workers in any art amateurs? that is, those who have a liking for or taste for their work; therefore, young upholsterers—followers of "a trade, sir, that I hope I may use with a safe conscience"—I have no doubt will find the columns of "Amateurs in Council" open to them, unless, indeed, perhaps, their enquiries are of a "too utterly too too" technical character.

But owing to said digression I find I am obliged to omit reference to Figs. 29 *et seq.* till next month, which I do with apologies, etc.

(*To be continued.*)

NOTES ON NOVELTIES.

By THE EDITOR.

60. LANCASTER'S CATALOGUE OF PHOTOGRAPHIC APPARATUS. 61. DESIGNS AND INSTRUCTIONS FOR MODELLING IN LEATHER. 62. THE AMATEUR'S FIRST BOOK FOR PHOTOGRAPHY. 63. "CHRIST HEALING THE SICK." 64. THE "LEE-CHASTER" PATENT ELECTRIC MOTOR. 65. FRENCH AND ENGLISH TECHNICAL TERMS. 66. THE WATCH JOBBER'S HANDY BOOK. 67. SMART'S PATENT SWIMMING PLATES.

60. MESSRS. JAMES LANCASTER AND SON'S *Catalogue of Photographic Apparatus.*—Messrs. James Lancaster and Son, the well-known manufacturing opticians, of 37, *Colmore Row, Birmingham*, have sent me their new "Catalogue of Photographic Apparatus for Dry Plate Photography," setting forth all the various articles for photography which are manufactured by them, with sizes, prices, and all necessary particulars. Messrs. Lancaster and Son's apparatus of all kinds are so widely known, and their excellence is so universally acknowledged, that it is unnecessary for me to call attention to any particular article. The price of the Catalogue is 4d., and it will be well for all readers of this magazine interested in photography to provide themselves with it, as they cannot fail to find it helpful to them in the prosecution of their hobby, and to glean much useful information from its forty-eight beautifully illustrated pages.

61. *Designs and Instructions for Modelling in Leather.*—Those who cannot use carving tools, or who do not care to try to use them, for the production of carved ornamentation in wood, may always fall back on the easier art of modelling in leather, for the attainment of which, Mr. W. Hanson, of the firm of Hanson Bros., 150, *Sefton Street* (*corner of Duke Street*), *Southport*, has issued a "Book of Designs and Instructions," which gives all the information that is required for the successful production of this kind of work. The instructions given with reference to the tools, materials, and varnish required, the methods to be followed in making leaves, flowers, fruits, etc., and fixing and finishing the work, are rendered more complete and useful by the accompaniment of twenty-seven illustrations, which serve as models for the production of brackets, mirrors, frames for pictures and chimney glasses, and baskets, book-stands, ink-stands, flower-stands, crosses, plaques, etc., etc.

62. *The Amateur's First Handbook for Photography.*—This capital handbook, which forms an admirable epitome of all that it is necessary for a beginner to know about the dry plate process, and whose title in full is "The Amateur's First Handbook: A Complete Guide and Instructor in the Art of Modern Photography," is written by Mr. J. T. H. Ellerbeck, late President of the Liverpool Amateur Photographic Society. It has now reached its fourth edition, and the information given in its pages is brought up to date in the present year, 1887. It is published at 1s. by Messrs. D. H. Cussons and Co., 79, *Bold Street, Liverpool*, and Messrs. Hamilton, Adams, and Co., 32, *Paternoster Row, London, E.C.* Mr. Ellerbeck is well known as a successful photographer, and his book shows him to be as fully capable of instructing others as he is in the practice of the beautiful art on which he writes.

63. "*Christ Healing the Sick.*"—This is the title given to a very beautiful mezzotint engraving, produced by Mr. S. Arlent Edwards from the original picture by Gabriel Max in the National Gallery, *Berlin*, and recently published by Mr. George Rees, *Savoy House*, 115, *Strand, and* 40--43, *Russell Street, Covent Garden, London, W.C.*, at £3 3s., artists' proofs, of which only 150 have been taken, and £1 1s. prints, the framing size being 32 inches by 21 inches. It is difficult to give the reader a fitting idea of the nature and beauty of a picture by description only; and, indeed, in this case, I very much regret my inability to place before my readers a small reproduction in miniature of the picture itself, which would give, far better than any words of mine, an idea of the merits of the picture as a composition, although it would utterly fail to convey the beauties of the engraving and the exquisite commingling of love and compassion displayed in the face of Him who went about doing good, the ever-blessed Saviour of mankind; the hope and expectation of the sorrowing mother, and the heavy eyelids and flaccid limbs of the suffering child. The figures are posed against a simple background, without a single accessory to disturb the eye and cause it to wander from the groups so forcibly and so beautifully pourtrayed. It is a picture that is highly suggestive, and one that can be gazed at with fresh pleasure every time it meets the view. I sincerely hope that many readers of AMATEUR WORK will be led to place it on their walls, not only for the beauty of the picture, but for the sake of Him of whose mercy and love to us it will ever prove to be a most impressive and perhaps most serviceable reminder.

64. *The "Lee-Chaster" Patent Electric Motor.*—Readers who are interested in motors generally, and especially those who are anxious to acquire a serviceable electric motor at a moderate cost, should send to Mr. R. A. Lee, 76, *High Holborn, London, W.C.*, the sole manufacturer of this appliance, for a prospectus of the "Lee-Chaster" Patent Electric Motor, and Lee's Patent Automatic Special Bichromate Battery. The motor, which is half-horse power, and costs about one-third the price of an ordinary gas engine, occupies a space of only 8 in. in diameter, and 8 in. high. Its price is £13 10s. It can be used for driving lathes, mills, fretsaws, pumps, organ bellows, drills, etc.; can be started, reversed, or stopped instantaneously, and will drive a 5-in. centre heavy geared or screw-cutting lathe, using the current from an 18-cell Lee's Patent Automatic Battery, which costs £10 10s., and is contained in a box 2 feet square and 20 in. high. There are no fumes given off, and no possibility of a shock from either motor or battery.

65. *French and English Technical Terms.*—This handy little book for the waistcoat pocket, whose title in full is, "A Pocket Glossary of Technical Terms, English-French, French-English, with Tables suitable for the Architectural, Engineering, Manufacturing, and Nautical Professions," is written by Mr. J. J. Fletcher, Engineer and Surveyor, and published by Messrs. Lockwood and Co., 7, *Stationers' Hall Court, London, E.C.* It is nicely bound in red leather, with gilt edges, but I do not know the price. It is a mistake to

my mind to call attention to a book, and say nothing about its price, but it will be well understood that the omission of this most desirable piece of information is due to the publishers, not to me. The Tables are various and useful, and chiefly show how to express either English or Continental Measures in terms of the other. The gem of the book, however, and its chief portion is the Glossary of Technical Terms, on which account I venture to recommend it to the notice of our French contributor, Professor L. Marissiaux, who, not long ago, was inquiring for something of the kind.

66. *The Watch Jobber's Handy Book.*—This is another of the useful series of "Handy Books for Handicrafts," compiled by Mr. Paul N. Hasluck, and published by Messrs. Crosby Lockwood and Co., 7, *Stationers' Hall Court, Ludgate Hill, London, E.C.* Its size and price, namely, 2s., are the same as those of "The Wood Turner's Handy Book" and "Metal Turner's Handy Book," to which attention has very recently been called in these pages, and with which it is uniform. Many readers of AMATEUR WORK are interested in Clock and Watch Cleaning, and these will not fail to derive much benefit and instruction from Mr. Hasluck's newest work.

FIG. 2.

FIG. 1.

67. *Smart's Patent Swimming Plates.* — I wish I had had an opportunity of describing these swimming plates earlier in the season, but it is better to call attention to them even late in the day than not at all. The "Patent Swimming Plates" are made on Smart's patent, and may be obtained by letters addressed "SMART'S PATENT, *Heathfield, Sussex.*" That they have met with the approval of good swimmers is evident from the opinion of Professor Finney, who writes respecting them: "They work in fine form. I have used other propelling plates, but in my opinion yours are the best, and gentlemen who go in for long swims ought to have a set, as a big journey can be covered in a short time after a little practice with your Patent Propellers."

FIG. 4.

FIG. 3.

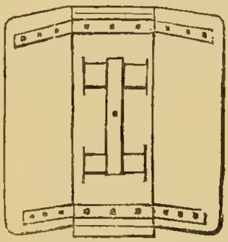


FIG. 5.

FIG. 1.—PLATE FOR RIGHT HAND. FIG. 2.—PLATE FOR LEFT HAND. FIG. 3.—PLATE FOR RIGHT FOOT, DRAWN BACK THROUGH WATER. FIG. 4.—PLATE FOR LEFT FOOT. FIG. 5.—UNDER SIDE OF FOOT PLATE.

The construction and action of the Patent Swimming Plates may be best understood from the accompanying illustrations in which Figs. 1 and 2 show plates for the right and left hand, respectively, and Figs. 3, 4, and 5, the plates for the right and left foot, Fig. 5 exhibiting the underside of the plate. It is said that they "give good swimmers great additional power and increased speed, on account of the immense hold they get on the water; and are invaluable to learners, as, by the support they give, confidence is quickly obtained; they are in no way detrimental, the action of swimming being the same with them as without them, so nothing has to be unlearned." Further, the Plates "are of great use as a life-saving apparatus in cases of shipwreck, being easily and quickly adjusted; and on account of their great buoyancy it is impossible for the wearer to sink, and the chances of soon reaching a place of safety are very much increased."

Referring once more to the illustrations, Figs. 1 and 2, the plates for the hands are shown outspread, by pressure against the water. Fig. 4 also shows plate for left foot, under the same circumstances; but in Fig. 3 the hinged portions of the plate are shown folded inwards by the action of the water, when the foot is drawn back at the completion of the stroke. Thus, before striking out it will be seen that the flaps of the plates, which are attached to the central parts by hinges, are folded and fall towards one another, but in striking out the sole of the foot the under part of the plate is pressed against the water, which causes the flaps to expand, and sweep the water with their whole surface to the finish of the stroke, when, immediately the foot is drawn up the plates close, thus affording no resistance to the forward movement of the swimmer. The plates are rights and lefts, both for hands and feet, the straight flaps of the feet coming to the inside, and the buckles to the outside. The plates are now on view in the Life Saving Court at the Liverpool Exhibition. They are fitted with straps, heel straps, and loops, by which they are easily secured to the hands and feet. From Fig. 5 it will be seen that in the underside of the plates for the feet there is a swivel which may be turned so as to fix the side flaps open. It is necessary to use this when walking, to prevent the flaps from being broken or otherwise injured by the weight of the wearer. The plates are thus a great protection to the feet when walking on a rough beach. To obtain the full advantage of the swimming plates, it is of great importance to press with their whole surface against the water; not with the edges. The prices, carriage paid, and sizes, are as follows:—

	Pair of Plates for Hands. ft. in.	s. d.	Pair of Plates for Feet. ft. in.	s. d.	Set of 4 Plates. s. d.
Extra Large.—	9 by 7	5 0	12 by 10	7 6	11 6
Large	8 ,, 6½	4 6	11 ,, 9½	7 0	10 6
Medium	7½ ,, 6	4 0	10 ,, 8½	6 6	9 6
Small	6½ ,, 5	2 0	9 ,, 7½	6 0	7 0

The sizes, it should be said, are approximate, and the small Hand Plates are without flaps; large Hand Plates, without flaps, but formed so as to get a good hold on the water, are supplied at 3s. per pair; medium ditto, at 2s. 6d. Special terms are named for twelve or more sets. When ordering the Foot Plates, it is best to select a size about the length of the foot.

AMATEURS IN COUNCIL.

For "Instructions to Contributors and Correspondents," see page 44 of this Volume, or Part 60, page 44.

Reflecting Telescope.

TRIO sends the following letter to Mr. Francis. TRIO'S letter is given *in extenso*, that Mr. Francis's reply may be intelligible to all readers.—"I have," writes TRIO, "an 8½ inch With telescope, but after reading your papers I hope to be able to make a 14 inch myself by hand. To gain experience, however, I am going to try my hand at a 10 inch first. As Chance Brothers want 16s. 6d. for a 10 inch disc, I have determined to have metal (cast iron) tools made, and have ordered them 13 inches in diameter (viz. about one-third larger), this costs about the same. I am having them cast to a 90 inch gauge, the concave tool chequered with 2 inch squares, and hope to be able to grind them true by hand with emery. I got a 7 pound box of Swedish pitch and 1 pound of resin, and as the pitch was rather soft I hardened it with the resin, and it now seems about right, but in melting them together the pitch boiled. I notice Brashear and Calver recommend the pitch being well boiled and "pulled," but I do not understand what Mr. Calver means by "pulled," which he says gets rid of the air bubbles. I have got two coarse emeries, slate colour, at 1½d. and 2d. per pound, and a flour emery at 1½d. per pound, and tried them with the "bruiser" (a 6¼ inch disc) and a piece of plate glass. By use of the three emeries alone a fine ground appearance was imparted, and then with the pitch and red jeweller's rouge, 8d. a pound (I cannot get purple, and it seems to be unknown), a polish was readily imparted. I must o course get some washed flour emery and make the finer emeries in the way you direct. If anything in the above calls for comment your assistance will oblige. I hope you will be able to reply soon, it is three months since my last query was sent, and no reply yet.

In reply to the above Mr. Francis writes:—"You are somewhat ambitious in attempting to make a 14 inch to start with. Why not try your powers first on a 6¼ inch, following my instructions implicitly, or even on an 8½ inch, using your "With" for comparison, both in shadow and final testing. Speaking from experience, I should say that you will be far more likely to make a 14 inch correctly after making a 6¼ inch than before. If you determine to make the larger instrument, however, you should make it 14 or 16 feet in focal length; this will make the correcting easier. The cost of the glass, 16s. 6d., is perhaps heavy. Did I not say somewhere that although it was necessary that the speculum should equal in thickness at least $\frac{\text{diameter}}{6}$ yet that this proportion was not absolutely necessary with the tool. You may use thinner (say 1 inch) glass for the tool if you support it well and evenly. You should have no difficulty with the metal tools. If you have not had the convex chequered do so, and spread a piece of sheet lead over it while roughing out. Your reference to a 90 inch gauge I do not quite understand; are the gauges arcs of a circle 90 inches or 180 inches in diameter? If the former your focal length would only be $\frac{90}{2}$ inches, or 3 feet 9 inches, which means failure. If the latter, I fear, as a first attempt you must not expect perfection; see remarks above respecting focal length. The pitch must never boil. Do you not see that boiling fills the pitch with tiny air bubbles, and so renders it unequal in density. The pulling is simply done to equalize the density of the pitch and increase its elasticity. Some folk pull home-made toffy in a similar manner. Soften your pitch by heat, tear it with your hands into strings and remelt it; but I have never found this necessary, nor should you. The pitch properly prepared according to my instructions will have no air bubbles in it. You may use the cheap coarse emeries if you choose, but you should get an expensive flour emery as you suggest. Was your polish good, I wonder, after all? I should say not. Really good rouge costs 6s. a pound; try at a chemist's; you only want an ounce or two. Do not think I am dissuading you from making a great mirror; on the contrary, I shall be interested to hear of your success, but why not feel your way first on a smaller one?"—[I myself deal with the concluding paragraph of your letter as given above. I am writing this on June 16th. Your previous questions, which according to your statements were sent three months ago, were received by me on April 6th, and forwarded on that day to Mr. Francis. Replies were received from Mr. Francis, May 4th, and sent to the printers May 5th. Your present question was received by me June 1st, and forwarded to Mr. Francis the same day. His reply as above was received June 15th, and sent to printers June 16th. Contributors to "ours" are all busy men and must attend to their own business first. Moreover, replies to queries, for the most part, require time for consideration. You will naturally ask, as this was sent to printers June 16th, why did it not appear in the July part. If you look at the date of application of the "Closure" in July part, you will see that it arrived too late for insertion, the Part being placed on the machine and printed as soon as possible after the date in question. Again, space is a powerful factor in my arrangements; it is impossible to get more into the pages allowed to "Amateurs in Council" than the pages will hold, and therefore, in some cases, it is a matter of necessity that replies, although in hand, are obliged to be held over till the next Part.—ED.]

Support for Boot Iron.

AMATEUR.—Get a block of wood, and having made a hole in it to receive the shank of the boot iron, drop the iron into it. You will find this kind of support the best that you can possibly have.

Grinding Chisels, etc.

AMATEUR.—You had better ask a carpenter to show you how to hold a wood chisel for paring, mortising, etc. With regard to grinding, you will find most useful hints on this subject in Mr. Thorold's papers, showing "How to Make a Treadle Tool Grinding and Setting Machine," which appeared in Vol. IV., pages 361, 410, 474, 538. As you have AMATEUR WORK complete, you can easily refer to the articles named. They are thoroughly practical and ought to be helpful to you.

Making Locomotive, etc.

AMATEUR.—The mode of making a model locomotive engine will be described by Mr. Pocock. He will not design a governor for the finished model, Fig. 79, for obvious reasons, nor will he show how to make a small brick (ornamental) foundation.

Meat, English and Foreign.

AMATEUR.—It is possible that your friend may be able to distinguish between joints of English and foreign meat, but this question cannot be entertained or settled in AMATEUR WORK.

Fan or Blower for Forge.

BLAST.—I do not consider the Root's Patent Hand Blower superior to bellows for blowing a forge fire. It gives a steadier blast than an ordinary bellows, but it must be driven at a very high rate of speed to get the necessary pressure, and is, therefore, not so well suited to an amateur's requirements as an ordinary fan or bellows. Driven by power from a gas or steam engine, a blower or fan is superior, but not by hand power. Blowers and fans are preferable to bellows when a steady blast is required for brazing. A circular continuous-action bellows, of 24 inches diameter, should be superior to a 36 inch pear-shaped bellows, and should give a blast of higher heating power, because delivered at a higher pressure from the reservoir compartment. An ordinary smith's fire requires at least 150 cubic feet of air per minute, delivered at a pressure of from ½ to ⅓ of a lb. per square inch.—G. E.

Casting in Plaster.

C. F. J. F. (*Hammersmith*).—To cause a "waste" mould to chip with sufficient freedom from the cast, thoroughly saturate the mould with water before filling it nothing more is necessary or desirable. To make a "piece" mould leave, the best thing to use is hog's lard, which does not discolour the plaster. Read the articles on "Casting in Plaster" in AMATEUR WORK, Vol. I., pp. 371 and 387.—M.M.

Drawing to Scale.

DITHE (*St. Petersburgh*) points out that his remarks on this subject in page 334, should have ended thus:

$$\text{"}\Delta\ ABC \sim \Delta\ DFB,$$

because all the angles are equal, and the triangles being similar, then

$$\frac{FD}{DB} = \frac{CA}{AB} = \frac{1}{3}\text{"}$$

With respect to the concluding paragraph of DITHE'S communication, AMATEUR WORK is a Magazine for men and men only.

Self-Acting Fountain.

CASTLE (*Abergavenny*).—You will find instructions for making Self-Acting Fountains in two papers on this subject by DONALD BEDE, in Vol. III., pages 74 and 559, otherwise Parts 25 and 35.

Boat and Canoe Building.

J. C. M. (*Galway*).—A series of papers entitled "Boat Building for Amateurs," appeared in Vol. I., pages 179, 224, 325, 483, otherwise Parts 4, 5, 7 and 11. Another paper, "Hints on Canoe Building," appeared in Vol. II., page 384, otherwise Part 19. This was followed by a paper entitled "A Canvas-Covered Sailing Canoe," Vol. IV., page 274, otherwise Part 41, which was accompanied by a Folding Sheet, and in Vol. V., page 126, otherwise Part 50, is a short description of "Boat Building with Willesden Waterproof Paper." All the parts are kept in print, and the Magazine from the commencement can be obtained in Parts or Volumes as may be desired.

Mark Mallett's Furniture.

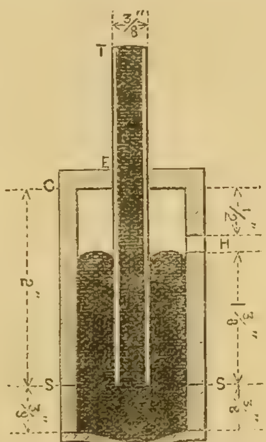
COLONIST writes :—"From this end of the world (namely King William's Town, South Africa), allow me personally to thank your valued contributor, Mr. Mark Mallett, for his series of papers. To a Colonist they are simply invaluable, and if you could look round the room I am now writing in you would see Mark Mallett all round you. I am not a new subscriber, for I own every number of AMATEUR WORK from the beginning, having purchased all the back volumes. And I am pleased to be able to tell you that the papers on Soap Making alone have saved me more than the cost of the Magazine. I probably should not have written this letter but for the letter headed THE GROWLERIES (February Number just to hand), E. T. B. (*Cheltenham*). If that good gentleman would plant himself in some of the wilds of this country, and be obliged to furnish his house himself, or do without, he would possibly find that working paid him better than growling, and he would be as thankful for his monthly number as I am. May the Magazine flourish and may Mark Mallett continue writing till Colonists begin to grumble." —[COLONIST's letter is dated February 17th, 1887. It came into my hands June 15th, 1887.—ED.]

Vehicle Moved by Spring.

STADT DRESDEN writes :—"I am unable to give the information you ask. At the time I saw the machine (about nine months ago), I looked upon it as an expensive joke rather than a useful article. It was designed by a clockmaker of this town, whom it has taken ten years to perfect, at the cost of upwards of 12,000 marks. I was told that he was taking out patents all over Europe. The machine, as I saw it, was a very crude contrivance, the driving gear was simply a pair of magnified clock-spring barrels about 12 inches in diameter, each having a chain wheel at one edge. The chains ran round a pair of wheels on the drivers of the same size as those on the spring barrels. The springs were wound by a pinion engaging a pair of large wheels; but I thought it was a great disadvantage to have to dismount to do so. The weight of the machine complete was 300 pounds, and the diameter of driving wheels was 2 metres. I was told that it was contemplated making the wheels smaller and gearing them up. The last I heard of the inventor was that he was trying to sell his patents, and there was some talk of getting the machine remade in a bicycle factory. The machine I saw was being put together by a machinist who once worked for me, and to whom I took a fancy for his English-speaking abilities. I have since quarrelled with him, so I don't like to go to him and ask him about the tricycle. His address is R. Kayser, Josephinenstrasse 19, if it is of any use. I think he knows the inventor."—[If JACK will take my advice he will let the "vehicle moved by springs" alone altogether.—ED.]

Cistern Barometer.

R. S. H. (*Dover*). -- Referring to the article on the "Cistern Barometer" in Vol. I., I append a half size sectional drawing of the cistern, which I believe will make the matter quite clear. The small wooden cup should be turned out of some hard wood, measuring (outside) $1\frac{1}{4}$ inches in diameter by $2\frac{5}{8}$ inches, inside measure being $1\frac{1}{8}$ inches by $2\frac{3}{8}$ inches deep. This done a ring should be cut off at S S, measuring $\frac{3}{8}$ inch, to the bottom of which is glued a circular piece of good



CISTERN OF "CISTERN BAROMETER."
Scale, half size, or 6 inches to 1 foot.

stout leather. After it has been glued in position it must be pressed well in the centre so that it will easily bulge inwards. When the tube has been filled and all is ready glue both surfaces of the ring where drawn, and press them together, being particular of course not to get any glue inside. I should strongly advise you to use "Le Page's" fish glue, 6d. per bottle, and apply it thinly, as this makes the best joint. If the subsequent operations are not rendered clear enough in the Magazine write again, when it shall have my best attention.

C. A. P.—[With reference to your remarks on other matters, I myself should like to see AMATEUR WORK issued weekly, and no doubt this would be done if the monthly circulation doubled itself. The Magazine is not yet so widely known as it ought to be, and I trust present readers and subscribers will do their utmost to extend its circulation, and therefore its sphere of usefulness. I am afraid you would not be able to place much reliance on very cheap tools. Tools and appliances for mechanical work, to be worth anything, must be well made and made of the best material. Why not look up the second-hand dealers, you will get many a good tool there for a mere trifle.—ED.]

Extension Camera.

H. G. R. (*Sunderland*).—I note your request, but it is not within my power to satisfy it at present. However, the promised papers on making Half-plate Extension Camera, by Mr. C. A. Parker, will be furnished in due course.

Alarum Clock.

G. M. (*Dublin*).—Your remarks on the construction of your alarum clock are not clear enough for publication, but as your contrivance seems very simple and easily managed, you might get a friend to help you with the details of description, diagram, etc., and send me an amended account. Your plan of multiplying fretwork designs is well known.

Threading Inside of Stuffing Boxes.

F. A. M.—I have screwed the inside of the stuffing boxes both in the lathe with a chaser and also with a tap; perhaps more frequently by the latter method; using three taps one after the other, the last one of course being a plug tap and cutting the full thread.—J. P.

Darkening Oak by Fumigation.

ALPHA.—You may obtain the result required by hanging up the piece of oak for some little time in a stable, and subjecting it to the ammoniacal fumes rising from the bedding of the horses. MARK MALLETT himself uses no other plan. There is no apparatus made or sold by which the darkening can be effected more rapidly, but there is no doubt that by putting the oak, with ammonia, into any well-closed, and therefore, air-tight, chamber or receptacle, you will be able to darken the oak more speedily than by leaving it in the stable.

F. S. P.—No apparatus can be described by which this can be effected more rapidly than by hanging up in stable, as recommended by BEE, Vol. V., p. 382?

Aquarium.

J. P.—I have a practical paper in hand on the making of an Aquarium, which will appear as soon as I can find room for it. Meanwhile you may derive much assistance from a perusal of Mr. DONALD BEDE'S papers, entitled "Ferneries: How to Make Them and Manage Them," which appeared in Vol. II. In Chapter IV. of this series (Vol. II., page 586, otherwise Part 23) you will find a receipt for cement. This, however, is for a framework of metal. Your frame being of wood you must paint the rebates with white or red lead, then insert the glass (which should be cut to fit as closely as possible) with the same material, finish with putty and white lead mixed well together, and finally paint over the putty.

Grandfather's Clock.

TEMPUS. — Before instructions can be given you for renovating the case of your "Grandfather's Clock," you must send a rough sketch of it and point out the parts in which repairs are required. Mark Mallett, one of our contributors on old oak, would like to have something definite before him. Working on supposition only, he might give you instructions which would be utterly foreign to your purpose.

Roller-Blind Shutter.

Lex. — (1.) Mr. A. A. Harrison lately described the construction of a Roller-Blind Shutter in the *Bazaar, Exchange and Mart*, in the issue of May 29th or June 3rd, the precise number I do not remember. (2.) I have never seen Thornton's Flexible, Non-breakable, Focussing Screen. It is, I believe, a patent, and supplied only with J. E. Thornton's apparatus. Doubtless the patentee will be willing to adapt it to any other manufacturer's camera.—C. C.V.

Screwing Apparatus.

Amateur could get the pattern screws cut by any one who uses a slide-lathe with long leading screw and change wheels; if he sends the blanks bored, fitted to seat and turned to size, then the workman would have to make a mandrel on which to drive them and could then "thread them," that is, cut the screw thread for about a shilling each. Yes, certainly, there are ways of utilising the slide-rest, either by gearing or by bands as from the overhead; but all these take longer to rig up and depend for their accuracy upon the slide-rest screw, which is sure to get worn. The traversing-bar is intended for the short screws in wood, brass or ivory, most often required by the amateur.—F. A. M.

Overglaze Painting on Porcelain.

E. W. (*Richmond*).—There has been no omission. The errors in numbering of chapters and paragraphs have accidentally crept in through the publication of the successive papers at long intervals, owing to the writer's incapacity to continue them otherwise on account of eye-troubles, as he has explained, and owing to this he has failed to make the sequence complete, and this escaped my notice prior to publication.

Moving Model in Fret Work.

Pirie (*South Africa*).—I do not see any way to the construction of Moving Models in fretwork, three feet by two feet, driven by clockwork springs. A model in *fretwork* would be utterly wanting in the resemblance to the genuine article, in point of form, colour, etc., that lends a pleasing appearance to constructions of this kind. The principles on which moving models are made have been explained in the papers to which you refer, and you have only to adapt these to give motion to parts of any external picture that you may select, making them of such a size as you may desire.

Messrs. Harger Brothers.

Pirie (*South Africa*) writes:—"Allow me to say a good word for Messrs. Harger Brothers, *Settle, Yorkshire*, and, at the same time, recommend them to my brother amateurs who may be in want of anything in the fret line. I have found them most fair and obliging. Anything they have not in stock they procure and forward with their own goods, charging nothing for the trouble.'

Lessons in Turning.

Pirie (*South Africa*). — Arrangements have been made to satisfy the requirements of yourself and others with respect to the A B C of Turning, at an early date.

Universal Simplex Type Writer.

H. P. N. (*Belfast*) writes:—"The annexed newspaper cutting mentions some advantages connected with the Universal Simplex Type Writer. Kindly inform me where it can be obtained, and whether it is likely to be effective, as the price seems very low?"

"Type Writers, so largely used in the United States, are now claiming great attention on this side of the Atlantic. The Universal Simplex Type Writer, which, from its low price (10s. 6d.) comes within the reach of all, seems to meet the requirements of the mercantile community at large. It is said to be capable of writing at least thirty words per minute. It has this exceptional advantage over any other type writer, that it can be used for writing in a bound book. A further advantage is the ease with which a fresh dial plate can be substituted. These dial plates may be had with accents and characters suitable for writing in German, Russian, etc., etc. There seems every prospect of this simple, cheap, and apparently thoroughly effective article being largely adopted in this country."—[A Company has been formed for the manufacture and sale of this Type Writer, and was advertised in the *Standard* of June 14. Prospectuses, with description of Type Writer, may be had on application to the Secretary *pro tem.*, Mr. F. Drake, at the Company's Temporary Offices, 11, *Poultry, London, E.C.*—Ed.]

INFORMATION SUPPLIED.

Oil Cans.

Semper Eadem writes:—"In answer to H. J. W. (*Newport, Mon.*), herein I give the sizes of the bodies of oil bottles, not oil cans; the biggest size oil can or oiler, as some people call them, never holds more than a pint. The following are the sizes from pint to two gallons: 1 pint cut, 10 inches by 4⅝ inches; 1 quart cut, 14 inches by 5 inches; ½ gallon cut, 18¼ inches by 5¼ inches; 1 gallon cut, 22 inches by 7½ inches; 2 gallons cut, 28 inches by 10 inches. These sizes, after being made up with the cone-shaped top and neck, will hold rather more than the quantities given, so as to hold the quantity after rebottoming and repairs. These are the sizes from which hundreds are made in our workshop every year."

INFORMATION SOUGHT.

Pneumatic Bells.

R. A. W. (*Dublin*) writes:—"I should feel obliged for instructions for making and fitting a pneumatic bell, with and without indicator. I cannot find that the subject has been treated of as yet in this Magazine."

Oil-gas Making.

R. A. W. (*Dublin*) asks:—Can any reader give me instructions for making a simple apparatus to generate gas from benzoline or other spirituous oil, to be used in ordinary fittings, say for two or three lights?

Speaking Tubes.

R. A. W. (*Dublin*) asks:—Is there any reason why speaking tubes should not be made very much smaller than at present (generally three-quarter inch diameter)? Would not the smallest piping, such as used for gas, or that used for pneumatic bells, carry the sound equally well if not better? Has the length anything to do with the size of the tube?

Type Writer.

D. B. A. asks:—Can any contributor give us a paper on the construction of a simple, inexpensive, and efficient Type Writer? I fancy it might be well appreciated by others besides your obedient scrawler.

Musical Glasses.

Amicus writes:—"Will some reader give directions for the construction of a box of Musical Glasses? I think I have heard that drinking glasses of various sizes are used and tuned by putting water in them."

Copying Machine.

J. J. M. (*Holywood*) writes:—"May I request instructions in an early Part, showing how to construct an apparatus for taking a number of copies of letters, circulars, etc., in black, without needing washing off each time like an ordinary 'Graph.' Many such are advertised, but the price is prohibitive."

Gongs for Hall Clocks.

Tempus asks:—Will some one tell me who sells the fine gongs and bells for hall clocks in sets for the Westminster Chimes, and the probable cost?

Cocoa Beans.

Amateur writes:—"A friend has given me several pounds of cocoa beans, just as imported. How can I turn them into use, *i.e.*, for eating or drinking purposes?"

Manufacture of Pottery.

S. S. wishes to ascertain the best works on Modelling in Common Clay, including Glazing and Kiln Baking—in fact, the various processes in making pottery. How can he construct a small kiln? and also a potter's wheel? Perhaps these particulars may be in the books mentioned. He has Morton Edward's work on Modelling in Clay and Wax (Lechertier, Barbe & Co.), but this work has only a small portion of information which S. S. requires. Any other information will be gratefully accepted.

Lake-Cremona Discoveries.

S. M. L. (*Goderich, Canada*).—Will some of our musical amateurs kindly inform me in what papers or magazines (giving dates) I can obtain all the Lake-Cremona Discoveries; am very anxious to read them up. —[I saw some letters in the *Standard* on the subject, but the upshot of the correspondence seemed to be that very little importance was attached to the matter, therefore I did not cut them out and preserve them.—Ed.]

LETTERS RECEIVED UP TO JULY 6.

A Young Binder (No reply received for you yet); A. F. C. (*Madras*); F. A. M.; Carpenter; A. M. (*Aberfeldy*); W. H. S. (*Crewe*); E. L. (*Esholt*); Colonist; Stadt Dresden; A. K.; H. W. (*Newton Abbot*); A. R. M.; "Ceevil" Engineer; Linden Tempus.

TOP

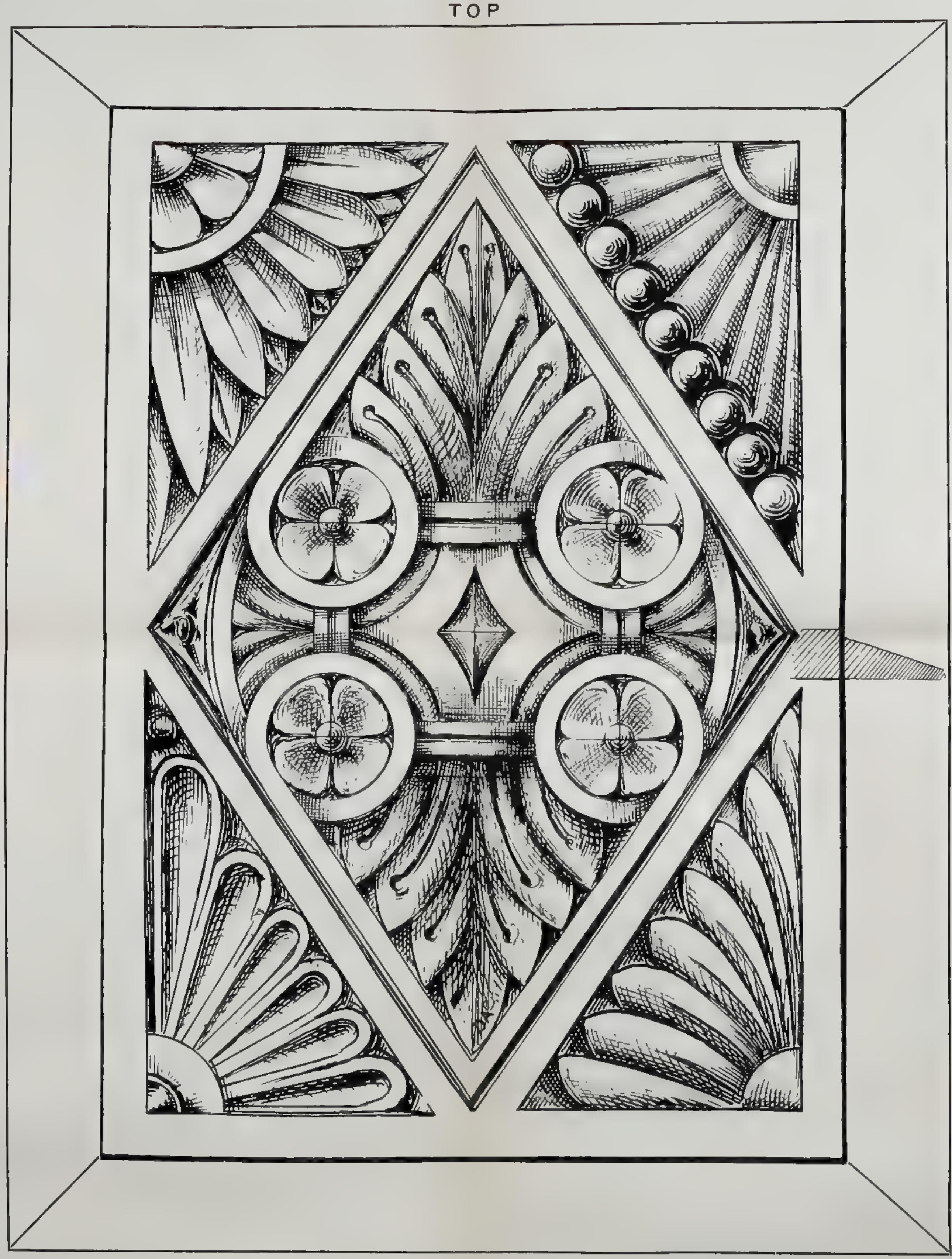


FIG 21

TOP

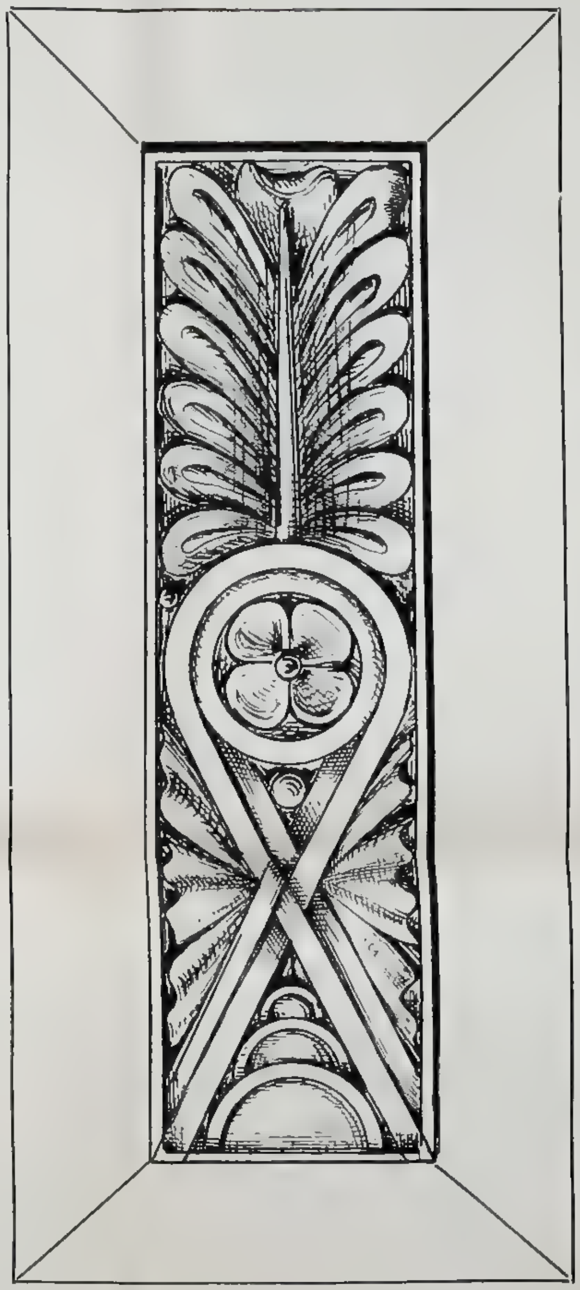


FIG. 22.

CARVED PANELS FOR OVERMANTEL

(FULL SIZE),

Exhibiting the Alternative Modes of Treatment for Corners, etc.,

DRAWN FOR

"AMATEUR WORK, ILLUSTRATED,"

BY

DAVID B. ADAMSON.

AN OVERMANTEL FOR AMATEURS.

HOW TO MAKE IT AND FINISH IT.

By DAVID ADAMSON.

II. CARVED PANELS AS SUBSTITUTES FOR LOOKING-GLASS.

(*For Figs.* 21 & 22, *see Folding Sheet issued with this Part.*)

IN the preceding article, treating on the construction of an Overmantel, the description has been for one in which all the panels are of looking-glass. By the way, in giving the approximate cost of glass, no mention was made of market fluctuations in price, of which I have been reminded by a considerable rise since calculating the figures given. It is also, I think, generally understood that there will be a further rise before long; and as the prices named were the lowest remunerative to a retailer, the purchaser must be prepared to pay more by the time this appears, or be satisfied with a lower quality than was estimated for. Although only glass panels have been mentioned, it by no means follows that this is the only material that may be used, and to some a little variety may be more pleasing. Well, if so, by all means substitute something else, for there is no fixed rule or canon of taste which ordains that as much glass as possible shall be put into an overmantel. Some authorities, indeed, object to more than a limited use of mirrors on account of the glitter of glass destroying the repose which they aim at producing in their schemes of decoration, so that in suggesting carved panels no violation is offered to the æsthetic mind. Perhaps it may occur to some that an overmantel need not have any glass panels, and that without them it would be more in accordance with the idea conveyed by the name of this piece of furniture. Were the design given intended merely as a reproduction of the old-fashioned overmantel, this would be correct; but though an old and very appropriate name has been revived, the article it represents has totally changed in character from its prototype.

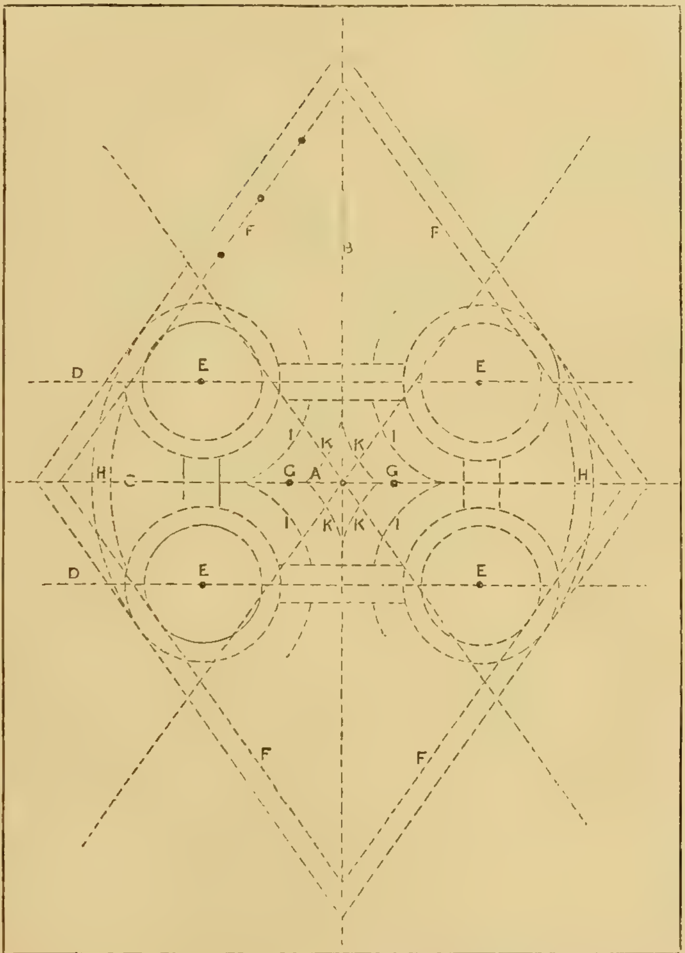


FIG. 23.—CONSTRUCTIVE LINES OF CARVED PANEL SHOWN IN FIG. 21.

The modern popular overmantel is essentially light in construction, and adapted to the altered condition of times in which plate glass is no longer unobtainable or costly. The fact that glass sufficiently good for silvering in large pieces was not to be had till comparatively lately, seems occasionally to be overlooked by those who object to it, and imply that its sparing use formerly is an evidence of the innate artistic taste of our forefathers. It certainly was not much employed by them, but probably for the same reason that they did not use express trains, telephones, telegrams, and other little inventions which are not generally looked upon as conducive to repose, though very convenient. If we are to cultivate the false æstheticism which would refuse to avail itself of the improvements that have been made in articles of luxury, let us be consistent and have nothing to do with the marvellous contrivances which our age has brought forth in almost every branch of art and craftsmanship. We cannot do this, but we can, and ought to, endeavour to work in the same spirit as that which actuated the craftsman of bygone days—that

to say, if he did honest work, for it may without uncharitableness be supposed that there were skulkers then as now. With these we can have no sympathy, therefore let them rest and not trouble ourselves about them. From the others let us learn our lesson, and instead of going to sleep or sitting down with folded hands and sluggish brain, deploring the good old days when art and genuine work still lived, try what we can do to improve ourselves and, consequently, those who come after us. We have derived benefits from those who went before us, why should we be content to make no advance. Can we do so without labour, without thought, as it were automatically? No; depend upon it, we can produce no good thing without *work*—downright real work, not play. If we take an interest in our work, not regarding anything as too trivial or paltry, then we sink the mere labourer in the artist, or thorough worker, as he may be called. Now-a-days it is the correct thing to be "artistic;" one hears a good deal about art, but it is a timorous kind, afraid of launching out into anything new, content to copy the old lines without effort at new developments. Is this the way men whose names have been handed down to us, renowned for their skill, worked? No; if we look at their work, whatever it may be, we find that without ignoring the old they ever strove to make the best of their present surroundings. They worked *from* the past, not in it, deriving their inspiration from familiar objects, and endeavouring as far as in them lay, to improve, possibly without a notion that they were anything but earnest painstaking workmen, not blind to their own skill as being superior to that of many of their contemporaries, but without parade of being art-workers. Had they lived ostensibly for art alone, probably they would now be unknown; but their thorough good work, that it is which embodies their art. First the skill in manipulating the raw material of their work must have been acquired, afterwards that subtle feeling, which we call art, engendered of combined skill, knowledge, and perception, manifested itself. But my—I trust indulgent—reader may ask what has all this got to do with carved panels for an overmantel, which, after all, can scarcely be held up as a work of art. It does not aspire to such a dignity, but perhaps the suggestions given may not be fruitless, and if so, they, crude as they are, will serve a useful purpose. Remember, my brother amateur, to whom they are as familiar as your mother's knee was in your childhood, that they were once new ideas to us, and may be new still to those who are younger than ourselves, to those whom it is our duty and our privilege to instruct even in any trifle which may serve to make them useful men. Not without diffidence, feeling that it may almost savour of presumption, do I write thus for a magazine which assuredly is not principally read by idlers, but by men whose own experience has doubtless taught them more forcibly than any words of mine can do, all that I would urge on the importance of genuine work.

Do not mistake me, you who are ahead of me: I do not assume to teach you; but knowing the difficulties that have been encountered, let us offer a kindly hand to help our younger friends forward. With this remark let us look at the work proposed practically.

There is no reason why any or all of the panels in the overmantel may not be of wood or other material than glass, but it will probably be the idea of most that the centre panels should be mirrors. Any of those at the side may be carved, but if all were so treated the effect would be rather heavy. The two immediately under the bottom shelves—that is to say, one on each side and the narrow pair on top, if the left-hand design be selected, will look very well carved.

The panels of the cupboard in the right-hand design may also be carved. Figs. 21 and 22 (see Folding Sheet) are full-sized designs for the panels under the bottom shelves, and for those at the top. Perhaps it would be better to say that the sizes are approximate, as for reasons given on page 442, when referring to measurements of glass I am unable to do more than this. The designs are, however, so simple that they may easily be adapted to any size or proportion.

It may be interesting to state that this design (Fig. 21) is founded on an old oak panel I met with some years ago while on a cycling tour. As usual, when I get to any out-of-the-way hamlet—not an uncommon occurrence with cyclists—I keep my eyes open for old fragments of woodwork, with the result that I have been frequently rewarded by meeting with something which, though of little intrinsic value, is interesting and obtainable for a mere trifle.

The panel in question when I saw it was very dirty, not to say filthy. If I remember rightly, I looked it up in an old outhouse, where it most probably had lain for years. On rubbing the dirt off, I was particularly struck by observing that what may be called the constructive lines of the designer were still visible, and on analysing them I was able to trace the method he has pursued in setting out his design; and with a view to indicating how the study of even an apparently worthless piece of work may not be unproductive, I give the principal lines in Fig. 23, the others, and measurements which are not shown, being unimportant, or, at least, unnecessary for the purpose of enabling the unskilled draughts-

man to reproduce the design on a panel of any size or almost any proportions.

The centre, A, having been formed by lines from corner to corner of the wood, the perpendicular, B, and horizontal, C, are drawn through it. The outer line of the carving is then drawn; then the lines, D, on which are the centres, E, of the small circles, struck of course, with compasses, and also of the segments, I and K. F is drawn at the same distance from the outer line, as the distance between the outer and inner lines of the small circles, the continuous band or ribbon seen on the completed design being formed by segments, H, from the centres, G. The remainder is drawn in by free-hand, but if the points of the leaves are marked on F, as shown by the dots on it, little difficulty will be experienced.

For the corners of the panel, which were, with exception of a few incised lines, left blank in the original, in Fig. 21 four different designs are given, one or other of which should be chosen, as they are given for selection, not to be reproduced individually on a panel. The same remark also applies to Fig. 22, where alternative designs are given on each half.

It must not be understood that the carving represented in Fig. 21 is an exact copy of the original—far from it. The original, though not without a certain rude vigour, was very rough, having been apparently carved by some joiner or carpenter, to whom, after he had formed the chest or whatever the panel was part of, the idea occurred that it looked plain and might be improved by a little carving, which was indicated rather than cut, evidently with ordinary carpentering tools. Had his tools been better adapted to the purpose, no doubt his work would have been finer. He did not leave his work in what, to our eyes, seems a rough state because he preferred roughness, but because his tools, and possibly his skill, did not allow of higher finish. Now, when good carving tools are to be easily obtained, and explanations are freely given, it would be absurd were we to endeavour to imitate the coarseness of the old panel. We can catch its feeling and spirit without actually copying it, which would serve no good end.

For the rest the work is simple, and a few tools will suffice. The carving is nowhere deep, nor is under-cutting necessary; all that is required is that it should be regular. The panel, Fig. 22, is intended as filling for the space above the top shelves of design on the left-hand side of overmantel, and if the cupboard shown on the other side of it is to have carved panels, I don't think any difficulty will be experienced in adapting it to the ends. Fig. 21, of course, will do very well for the doors. On it the thickness of the panel and bevel are shown in section.

I would here give a word of caution to makers. Don't make the bevel too heavy; that shown on the drawing is ample. I call attention to this as I have lately been favoured with photographs of some work done by a clever amateur woodworker, in which the bevels are shown out of all proportion to the rest of the details. This may not seem so to those unaccustomed to consider such matters, but it is by regard to such apparently trifling points that the skilled worker proves superior to the amateur; who cannot, unless his attention is called to them, be expected to observe them till, perhaps, it is too late to remedy defects.

The article of furniture which has caused these remarks seems to be admirably got up; and should the maker of it read this, I trust he will not be adverse to the friendly criticism which will serve to indicate how others may avoid—I will not say defects—but rather little blemishes of a similar character.

Figs. 24 and 25 give other designs suitable for panels. They will look equally well if cut as shown without bevels, and, no doubt the fret cutter will perceive that he may save himself the trouble of grounding out by fretting the design on thin wood, say $\frac{1}{8}$ inch thick. I may, however, state that this method is not considered a legitimate one, as savouring too much of an attempt to produce effects by meritricious means, although, personally, I cannot altogether agree with this, or I should not name this means of reducing labour. The fret, in order that it may be easily carved without injury to the ground of the panel on which it is to be fixed, should be temporarily attached to a piece of soft wood to serve as a support during the carving. If glued on it would be difficult, if not impossible, to separate the two without soaking in water or breaking the work. The former, of course, is not to be thought of, and the latter would not be advantageous. Therefore put a piece of soft paper glued on both sides between the two pieces. When the work is finished the paper may be readily split without injury to the carving. When laying the carving on the panel care should be taken not to use too much glue, or if any of this exudes to remove it before it gets quite hard; the ground should be afterwards punched. If proportions or sizes of these panels require to be altered, a little facility in drawing will be of advantage, but for those who may fear to attempt the work because of their inability to draw the four quarters exactly alike, I may say that it is only necessary to draw one of them. Start by roughly sketching one of them, either on the panel or on a piece of paper, with charcoal—the kind sold by artist's colourmen; this easily dusts off, so that errors may be erased and lines improved until the desired result is obtained. Then trace either with ink or pencil on tracing paper over the correct lines, and a

FIG. 24.—CARVED PANEL FOR OVERMANTEL. HALF SIZE.

drawing which may be seen from either side will have been made. All that now remains is to trace on to the wood, or paper to be stuck to the wood, with a hard point and a piece of transfer paper. With a little care the four quarters of the design will so closely resemble each other that no difference can be detected. The well-known method by which size may be altered of drawing lines to form squares on the small design, and on the space, either larger or smaller, which it is to fill, having been lately described in AMATEUR WORK, requires no special comment. Those who cannot draw at all will find the pantograph a useful contrivance to aid them in enlarging or diminishing a design.

Figs. 26 and 27 show a pair of slightly more elaborate panels. Fret-cutting will not be so much assistance with them, as it will be better to do the grounding out in the usual way, when the router, a tool too little appreciated or known among amateurs, should be used to avoid needless waste of time. I am indebted to one of my acquaintances for the following simple mode of making a router, the ordinary

FIG. 25.—CARVED PANEL FOR OVERMANTEL. HALF SIZE.

FIG. 26.—CARVED PANEL FOR OVERMANTEL. HALF SIZE.

form of which has been described already in this magazine in the excellent instructions which have been given on wood carving. The general construction and principle of working is exactly the same, the only difference being that the blade instead of being wedged or otherwise fastened in is formed of a screw. An ordinary wood-screw was taken, the thread filed away from the point for ½ inch or so, and the end sharpened like a chisel. This screw was then run through the block of the router, and held firmly by the remaining thread without fear of its working loose. Of course it is an easy matter to regulate the blade to any depth with the utmost nicety by using a screwdriver. The idea is a good one for a cheap efficient router. Those who require further instruction in wood carving cannot do better than refer to some of the back numbers of AMATEUR WORK, as to recapitulate would merely be waste of space, and if they cannot then learn all they want to know, enquiries in Amateurs in Council columns, no doubt, will elicit the desired information.

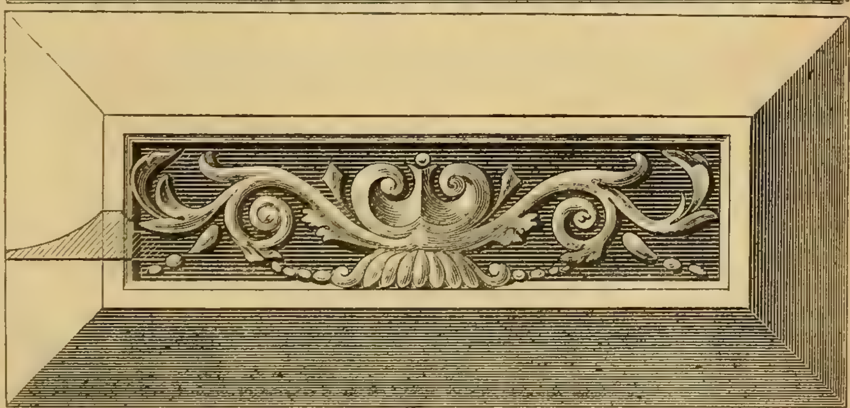


FIG. 27.—CARVED PANEL FOR OVERMANTEL. HALF SIZE.

PIANOFORTE REPAIRING AT HOME.

By J. H. MOODY.

II.—REHABILITATION OF FAULTY SECOND-HAND PIANO —RECONSTRUCTION OF ACTION—HAMMER-RAIL—BASS STANDARD—LUBRICATOR—SOCKET RAIL.

IN common with many other things which a century ago were complacently regarded by our grandparents as all-sufficient for their needs, the square piano, in whatsoever well-preserved a state we find it, is but ill adapted to the demands of our time; indeed, when confronted by some of the exactions of the present generation, we are compelled to own that it becomes well nigh useless, and the best report that can be given of it is that its employment is only just admissible for a pupil learning the elementary exercises; even under those conditions its utility is driven within very narrow limits. It follows, therefore, that when the pupil progresses toward the higher grades of instruction, the practice upon such an instrument cannot at all contribute to good execution, but will surely be productive of discouragement, which will result in neglect of lessons and ultimate abandonment of study.

Seeing, therefore, that our ancient acquaintance gives us such ample evidence of inefficiency, we regretfully decide to discard it in order to make way for an instrument with larger capabilities. Casting about for another instrument is then a time of anxiety, and may have a satisfactory result if good luck be for us or if good judgment be at hand to aid us; on the other hand, if it be our fate to be unattended by either of these two, our experiences may be the reverse of agreeable and like those of an individual who, similarly unblest, yet goes upon a like quest with no better protection against deception than his own conceit.

We will presuppose such an individual to have formed a great idea of a bargain in the shape of a secondhand instrument, and in pursuit of that idea to have taken counsel of the advertising columns of a newspaper, thinking them to be, which they undoubtedly are when employed in their legitimate capacity, an excellent means of communication between buyer and seller. Unfortunately, however, the same means are prostituted to provide a channel for the trickster who employs them to allure inexperienced purchasers for faulty goods, and the seeker after a bargain blindly enters the trap, pledging himself by the purchase of a pianoforte with many imperfections, which the dealer takes care shall be unrevealed until too late. The disadvantages attending advertising then become particularly appreciable to the poor pigeon who may well feel disgust at the reflection, that if he had solicited the advice of a friend with experience proof against the blandishments of unscrupulous dealers, all uncomfortable sensations would have been unnecessary. But the mischief has been done, and, alack! the time for the imperfections to assert themselves has arrived. I will briefly tell you what they may be: 1st, No better means of controlling vibration than dampers screwed into the tails of the keys; 2nd, No provision for producing "piano" or soft effects either in "celeste" damper or shifting hammer-rail; the two pedals are consequently dummies, or silent counterfeits; further than this, the arrangement of dampers is so disturbed by rapid playing, that some are twisted whilst others have fallen off to obstruct the keys and to cause discomfiture to the player. The appearance of the case certainly gives no intimation of the state of things existing within, for it is as attractive as carved walnut and fretted front can make it, and it is altogether constructed for the approval of those who forget merit in the bravery of outward appearance.

It only remains at this point for the unfortunate dupe while swallowing his chagrin to calmly survey his position; and to assist him to the attainment of that philosophic mood I will relate my experience of the reparation of a friend's piano, which I found in such a condition as I have pourtrayed.

It so happened that I had gleaned from various sources a certain sum of knowledge on the subject of Pianoforte construction, and had exercised the faculty of observation when I saw the interior of an instrument displayed to the public view, in the window of a dealer's shop; at other times I was fortunate in getting a closer inspection, and thus fortified, I essayed to supply my friend's bad bargain with the parts that would effectually produce the variety whence the instrument derives its appellation: these were a provision for shifting the hammer-rail by means of the left or soft pedal so that the blow of each hammer fell only upon one string, and a set of dampers to be individually raised by the stickers, and collectively raised by the right or loud pedal. This undertaking was a loftier flight than mere repairing, and seemed beyond the limit of my resources; but they who earnestly seek success may accomplish much by the observation of reliable rules, therefore I made enquiry, in the first place, into ways and means.

Bearing in mind that a practised hand hesitates to go to work unless properly equipped, it was scarcely necessary to urge upon me the advisability of obtaining adequate appliances. Although there are some who rather than procure them, prefer to stumble along with makeshifts, reaping disappointment in the end for their reward; as for me, I had invariably found that the need of efficient tools made itself evident, and I could always appreciate with infinite satisfac-

tion the assistance they imparted; accordingly, I procured a modest stock, chief among which were the following: A saw with fairly large teeth and distinguished by the term "half rip;" a jack plane and a smoothing plane; a dovetail saw seven inches long, making a very fine cut; a brace with bits of various kinds; a marking gauge, sundry marking awls and chisels, screw-plate and cutting pliers.

Being now furnished, I addressed myself hopefully to the task, beginning by removing the ornamental front and the fall, they being the coverings of the parts with which I had to deal. First the front kept in place by wooden buttons and dowels was taken off, then the fall was lifted out from the grooves in which it rested; these removals entirely exposed the action which also came out readily when the buttons that secured it were turned, and it was lifted forward and upward.

By consequence of the extent of alteration that I contemplated effecting, it was imperative as a preliminary to take the action entirely to pieces; the levers first were detached from the lower rail, after the glue joint of each one had been destroyed by the application of a warm iron, and separation had been completed by the insertion of a thin bladed knife. There remained now upon their rail the hammers, attached by substantial hinges of wood; levers and stickers were depending from them, and each part was connected with the other by a simple leather hinge. The screws holding the hammer hinges were soon withdrawn, and as each one of the hammers was detached I was careful in laying it aside, to preserve its order of sequence, so that no time might be lost in putting it into position again.

Should the amateur desire a choice of means for producing "piano" effect, I may refer him to an article ably describing the fitting of the celeste damper, and which was published in an earlier number of this Magazine. However, in this instance, although greater labour was entailed, I elected to use the shifting hammer-rail, but that alteration was impracticable without greater space for the necessary play between the standards or upright pieces, therefore, when I had denuded the action-frame of its furnishing, I detached the old lever-rail and the old hammer-rest, and discarded them both as being too short. I then prepared substitutes, in the shape of new rails made of 2 inch by 1 inch pine, but half an inch longer than their predecessors, and when they were finished I laid them aside until the proper time came for fixing them in their places.

The hammer-rail was rigidly screwed to the standards at the back, and I removed it, and found that it shared the delinquency of the other two rails in being deficient in length, but I could not afford to cast it aside or treat it with the same cavalier disregard as I did the others, as its peculiar shaping precluded the idea of making a substitute without special planes; however, I evaded the difficulty by jointing at either end with glue and dowels, a piece of mahogany ½ inch in thickness.

I also remember that the bass standard was too short to render support to some of the parts that I had undertaken to supply, and that I made a new one to take its place. It was made like the old one of a common quality mahogany, and was the same width and thickness, but 3 inches longer; the reason for the increased length will become apparent as we progress. The chief parts of the action frame were now ready for putting together, and that task was performed with care, all joints were made closely fitting to ensure strength, and a watchful eye was exercised to guard against an unsatisfactory condition of things, which the workman's vocabulary describes by the term "in winding"—in plain language, bending or deviating from the direct line of surface in a way that a work with a reputation for accuracy of angles to maintain should not do. This is a contingency that will beset alike both workman and amateur, and might arise from unseasoned material, but strict attention to planing and frequent use of the square as a work proceeds, is well repaid by the attainment of those particularly important elements, firmness and solidity.

In order to make the construction of the action frame as clear as possible, I will describe the operation step by step, while reference to Fig. 7 ought to assist the description and leave very little room for misunderstanding. I began with the standards which had been previously prepared with receptacles for the lever-rail and for the hammer-rail, and placed them upon the bench with the edges in which were those receptacles upward; the lever-rail was then arranged, with its dovetailed ends glued into their mortises. I then turned the framing over to get at the edges of the standards where the hammer-rest was to be fitted, this being the front of the frame, where neatness must be paramount, a joint necessitating no unsightly disturbance is usually adopted, and I made it in the following manner: the old hammer-rest was clothed with baize, and had been planed to an angle coinciding with the slope of the hammers as they lie back quiescent, consequently, its shape was not conducive to a close joint, but in the new rest I reconciled this incongruity, and at the same time contributed to the desired neat appearance by cutting away a portion of the wood at either end (see Fig. 7). The laps thus made were screwed flat on to the standards, in a position identical with that occupied by the discarded hammer-rest, and which was indicated on the old standard that I had retained in use.

The next step was the preparation of the mortises for the reception of the tenons or tongues at the ends of the hammer-rail. These tongues were left loose instead of being tightly screwed as formerly, and the rail had also gained the $\frac{1}{4}$ inch play as promised, whereby it might be shifted from left to right or *vice versa*, the shoulders of the tenons exercised a limit to this freedom, and a little filing of the mortises, together with a liberal application of blacklead, facilitated the easiness of working. When all this was done, and the fitting of the hammer-rail was found to be satisfactory, a couple of thin slips of mahogany were let in and screwed on the back of the standards to secure the tongues.

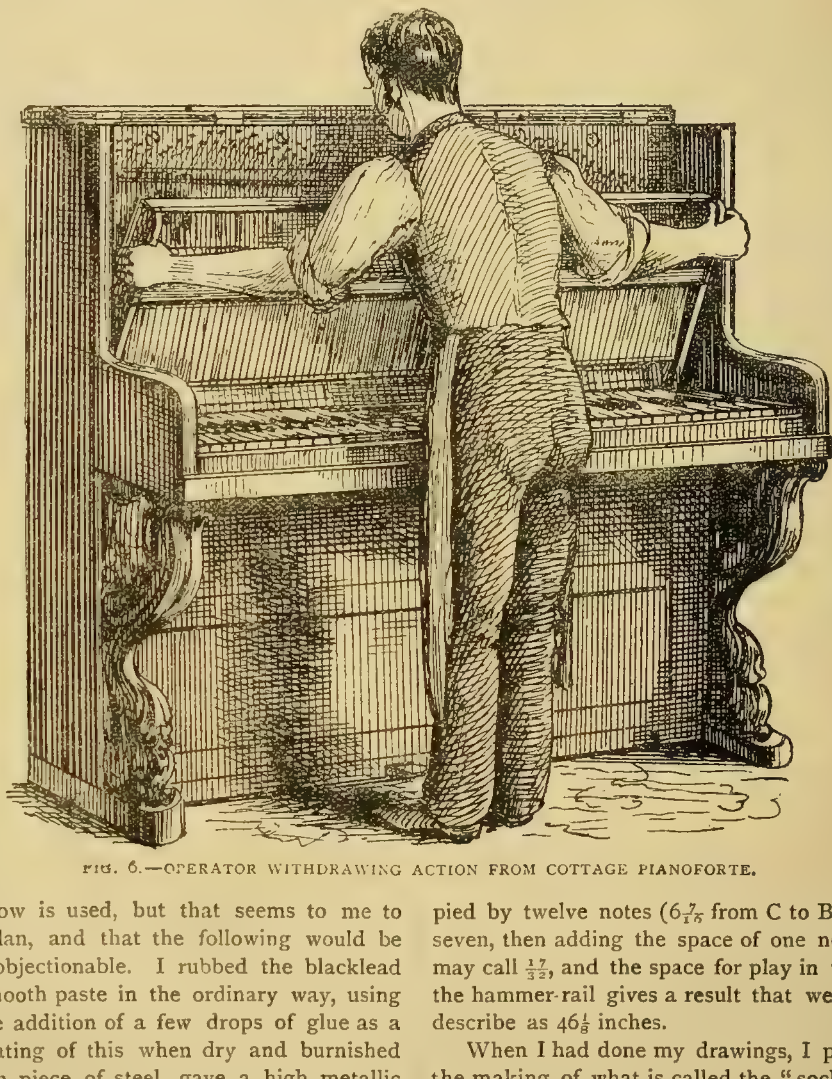


FIG. 6.—OPERATOR WITHDRAWING ACTION FROM COTTAGE PIANOFORTE.

As blacklead is the chief lubricating agent when wood surfaces are in opposition, I think that a few words at this point as to the methods of its application may not be superfluous. Sometimes a mixture of blacklead and tallow is used, but that seems to me to be a dirty plan, and that the following would be one not so objectionable. I rubbed the blacklead down to a smooth paste in the ordinary way, using water with the addition of a few drops of glue as a medium, a coating of this when dry and burnished with a smooth piece of steel, gave a high metallic polish which also possessed the quality of durability.

Up to this point, I had been merely retracing my steps along a beaten path, and my progress had been without serious check, but the way beyond led me over strange ground, and I hesitated to proceed in uncertainty. I conceived that if I planned out the remainder of the work upon paper, there would be no risk of making false moves, or of measurements being irremediably confused, therefore, to make assurance doubly sure, I set about making drawings of the action, and I curbed a feverish desire, begotten of anxiety, to push forward without preparation.

These drawings were intended to be a guide in fixing the socket and damper rails, and also in the due disposal of the space with which I had to deal; they consisted of representations of the wrest plank, and action frame, and also of the pedalling, and were drawn one-half full size. As I had the instrument before me, I found little difficulty in preparing them, but it may perhaps be useful to say a little more regarding the space necessary between the standards in an instrument with a compass of seven octaves. Multiplying the space occupied by twelve notes ($6\frac{7}{16}$ from C to B inclusive) by seven, then adding the space of one note, which we may call $\frac{17}{32}$, and the space for play in the shifting of the hammer-rail gives a result that we may broadly describe as $46\frac{1}{8}$ inches.

When I had done my drawings, I proceeded with the making of what is called the "socket-rail;" this was a slip of wood $\frac{1}{4}$ inch in thickness and $1\frac{1}{2}$ inches wide, bevelled down to $\frac{1}{8}$ of an inch along one of its edges, and its duty was to guide the damper lifts in their operation against their respective dampers. It follows, then, that in length it was rather more than

the space occupied by 58 hammers on the hammer scale; it may be made in pine, but a better job is the result when some white wood harder and not so liable to bend is used—say sycamore or maple. This rail was rendered efficient to fulfil its office of directing damper lifts by a series of holes, bored on a line gauged $\frac{1}{2}$ an inch from its front or bevelled edge, and clothed for silent action; the setting out for these holes was done with circumspection, for it was most important that it should perfectly agree with the scale upon which the hammers were hung; in order to ensure correctness in the latter particular, I placed the slip against the hammer-rail, and with the aid of the square I ruled upon it a scale to correspond, taking care to make the first mark $\frac{1}{8}$ inch from the bass end. The intersection of the gauged line made by the markings of the scale indicated the exact places for the holes, therefore I bored upon each one of these intersections with a $\frac{1}{16}$ spoon bit and soon had all the holes ready to clothe. Clothing of centres and holes is frequently called into use in pianoforte making, and the process at first glance seemed to give promise of difficulty, but a little thought reduced it to simplicity, and my first step was to expend a few pence at the marine store dealers, in the purchase of some scarlet cloth cuttings, the angular shape of which was as convenient as the supply was ample for my purpose; from these I selected only the pieces of better quality, and it became an easy matter to trim a piece to a sharper angle and thread its point in the hole that I desired to clothe, the cloth as it was drawn through, set closely round the sides of the hole and was held there by a little glue which was applied before pulling the cloth tight. When all the holes were clothed and the glue of each was dry, the ragged ends of cloth were trimmed close

REFS. TO FIG. 7.
A, Hammer Rail.
B, Slip of Wood to secure Hammer Rail.
C, Hammer Rest.
D, Lever Rail.
E, Standard.

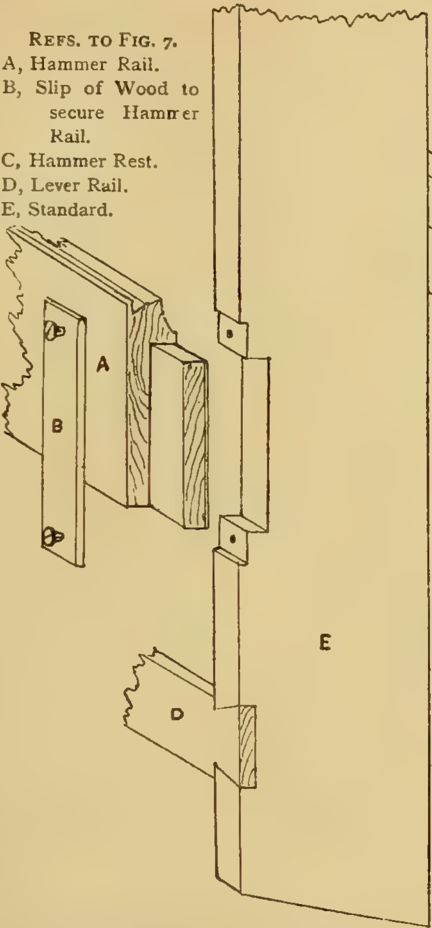


FIG. 7.—DIAGRAM SHOWING CONSTRUCTION OF ACTION FRAME AND PROVISION FOR SHIFTING HAMMER-RAIL.

FIG. 8.—SHAPE OF PROP FOR SOCKET RAIL.

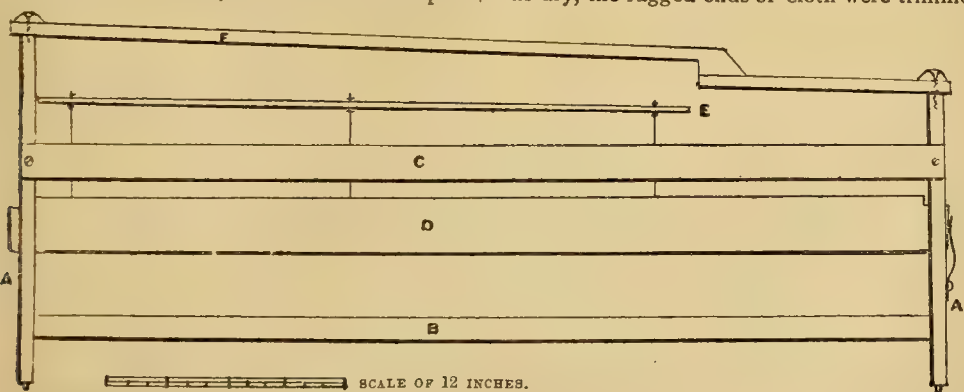


FIG. 9.—PIANOFORTE ACTION FRAME SHOWN IN ELEVATION, RECONSTRUCTED, AND WITH DAMPER RAIL ADDED.
A, A, Standards; B, Lever Rail; C, Hammer Rest; D, Hammer Rail; E, Socket Rail; F, Damper Rail.

up to the rail with a sharp knife, and every hole was broached by the insertion of a pricker or bodkin, to make a clear passage for the free working of the wire damper lifts. The damper lifts being attached to the left side of the stickers, at all cost had to be kept in a straight course lest they should resent the neglect by intercepting the hammer blow; hence the pains which I took that the holes in socket-rail should agree with the hammer scale and other precautions had a tendency to render any such contact impossible.

When the holes were quite finished I did not relax my care, but continued to exercise it, as I arranged the rail in position. A means of support for the rail was found in three props, which were made of brass wire stout enough to impart rigidity but slender enough to stand in the space between two hammers without touching either, they were tapped with a screw thread at both ends, and were shaped as Fig. 8; their lower ends being bent at right angles were screwed into the back of the hammer-rail at the following places, one between hammers 29 and 30, the other two respectively between hammers 5 and 6, and 52 and 53; fixed thus they were able to give adequate support for the socket rail at the ends and the centre. The holes in the socket rail were conveniently numbered from 1 at the bass end, and I was very soon able to fix upon the places where to bore for the reception of the props. I did this behind the holes which were respectively numbered 6, 30, and 53; the rail was then slipped upon the upper ends of the props, which in every case were provided with a couple of brass nuts, to effect adjustment to the proper height.

This completed the construction of the action frame, leaving it ready for replacing of the old parts and for the additions which will be described in my next article. (See Fig. 9.)

(*To be continued.*)

HOW I FURNISHED MY SNUGGERY.

Being Part III. of "My Furniture, and How I Made It."

By MARK MALLETT.

V.—MY GLASTONBURY CHAIR AND SMOKING-TABLE.

MY next effort was in the direction of an arm-chair. This I built somewhat after the Glastonbury model, as will be seen from the side elevation, Fig. 39. As this chair is much more complex in its structure than the last, it will be desirable that I should give working drawings of some of its parts on a larger scale. The legs are of 1 in. stuff, 2 ft. 3 in. long and 4 inches wide in the centre, though only 2 inches towards their ends. Fig. 41 shows one of these legs (that marked A, Fig. 39) as it appears from the side; Fig. 42 gives this leg as seen edgewise and from behind. The double width in the centre is to make up for the loss of strength consequent on each leg being half cut through to receive its fellow, as seen at B, in Figs. 41 and 42. Through their intersection it will be observed that a mortise is pierced, $1\frac{1}{4}$ inches high and $\frac{3}{4}$ inch wide, to receive the tenon of the cross-bar, which is brought through them and pegged on the outer side. Since the strain on this joint is very great, it is strengthened (in addition to the four round-headed screws seen on the outer side) by a piece of $\frac{1}{2}$ inch board screwed against it on the inner side. This board appears in Fig. 40; it measures 1 foot by 9 inches.

The cross-bar, already mentioned, is drawn at Fig. 43. It is of $\frac{3}{4}$ inch wood, and is 2 feet $2\frac{1}{4}$ inches long; it is 4 inches broad at its centre, but only $2\frac{1}{2}$ inches towards its ends, where the shoulders of the tenons touch the board last named, as shown by the dotted lines in Fig. 40. From shoulder to shoulder this bar measures $19\frac{1}{2}$ inches, and at each end the tenon projects $3\frac{1}{2}$ inches beyond those points. At slightly less than $1\frac{1}{2}$ inches beyond its shoulder, each tenon is shown to be pierced by a peg-hole. The combined thickness of the three pieces through which the tenon passes is $1\frac{1}{2}$ inches, and the hole is made a trifle nearer than that distance to the shoulder, in order that the peg, when driven home, may draw all the pieces tightly and firmly together. The end of the tenon is finished off in a pyramidal form, as shown in the diagrams.

Fig. 44 shows one of the side-pieces (C, Fig. 39). This, too, is of $\frac{3}{4}$ inch board; it measures 1 foot 10 inches by 4 inches. It will be seen from the diagram to have a little ornamental chamfering on its outer side; on its inner side—that towards the seat—its upper edges are neatly rounded off. The legs are firmly screwed to these side-pieces, not only with the round-headed screws which appear in the illustrations, but also with flat-headed ones driven from the inner side.

The cross-pieces of the seat, the ends of which are seen at D D, Fig. 39, are too simple to need separate diagrams. They are merely straight strips of $\frac{3}{4}$ inch wood, 3 inches wide, and 1 foot $8\frac{1}{2}$ inches long. Their lower edges are chamfered off, and their upper ones left square; they are screwed, as shown, to the under edges of the side-pieces.

In Fig. 45 we have one of the back-pieces. It is of $\frac{3}{4}$ inch board, 2 feet $4\frac{1}{2}$ inches long, and though only 3 inches broad through the greater part of its length it widens to 4 inches near its bottom. This greater width is not only given that it may afford more space for screwing to the side-piece, but also that it may rest for a longer distance upon the leg, to

which, as may be seen in Fig. 39, it is fastened by a screw. The outer edges of the back-piece are chamfered off as seen; the inner front edge is rounded, and the inner back edge is left square. Through this piece are two mortises, 2 inches high by $\frac{3}{4}$ inch broad, to admit the tenons of the back-spars. One of these back-spars is seen in Fig. 46. These spars are also of $\frac{3}{4}$ inch stuff; they are $2\frac{1}{2}$ inches wide, and from shoulder to shoulder have a length of 19 inches; the tenons project at each end $2\frac{1}{2}$ inches farther.

Fig. 47 gives an enlarged view of one of the arms—the left. This piece has the fault of cutting a good deal of board to waste; it is of $\frac{3}{4}$ inch stuff, and, as I have indicated by the dotted lines around it, will take a piece $24\frac{1}{2}$ inches long and $6\frac{1}{2}$ inches wide. Except where chamfered, as shown, or where they touch upon other parts, its edges are neatly rounded off on both sides. The dotted lines at E show where it is padded. It is screwed to both side-piece and back-piece, and helps materially to make the back strong and rigid. In setting the arm on, it must be remembered that the two parts to which it has to be attached are not in the same plane—the back-piece projecting $\frac{3}{4}$ inch farther than the side-piece—and that the ends of the arm will therefore require easing. The diagram, Fig. 48, is intended to explain my meaning. It shows the arm looking from above; F is the side-piece, G the back-piece, and H the arm itself. From this diagram it will be evident that between the back and I, and between K and the front, a considerable wedge-shaped slice will require to be taken from the arm before it can be made to fit. The arm will not, however, be materially weakened by this paring, as it will have to be made thinner in the broad parts only.

The frame of the seat, which is made separately, appears in Fig. 49. It is made of strips of $\frac{3}{4}$ inch wood, $2\frac{1}{2}$ inches wide. These are strong enough, since at the corners where they are somewhat weakened by being framed together, they rest on the cross-pieces of the seat, and have no strain upon them. This frame measures $18\frac{1}{2}$ inches by 20 inches, $\frac{1}{4}$ inch being allowed all round for the thickness of the coverings to be nailed upon it. I have shown it as crossed by the webbings which support the stuffing. Material for stuffing will best be got at an upholsterer's; the choice of the fabric for covering must, of course, be a matter of taste. After it had been stuffed and covered, I fixed my seat in its place with three round-headed screws driven into it on each side through the side-piece; they show in Fig. 39. A material addition is made to the strength of the chair by thus screwing in the seat, and whenever it needs to be newly covered or stuffed, the screws can easily be removed.

As compared with the seat, there is a little pressure upon the back, and a couple of webbings each way suffice for it. The upright ones go round the back-spar, and the horizontal ones I secured around little strips of wood, which I then screwed within the back-pieces, in a line with the back-spars. I also put a little pad on each arm and covered it like the seat and back. The dotted lines at E, Fig. 47, indicate its place. Of the illustrations to my Glastonbury chair, Fig. 39 is on the 1 inch scale, all the others are 2 inches to the foot.

My Smoking-Table.—To add to the conveniences of my Snuggery, I lastly made a small stand or table. This I intended to set beside my lounging chair, where it would be handy to hold any trifling matter which I might wish to have near me, such as a book, a glass, or a candle; and as I found it more especially useful as a depository for such appliances as I needed whilst indulging in the meditative pipe, I named it my Smoking-Table.

I made it as light, and of as small dimensions as it could well be. It stands only 1 foot 11 inches high, and the top measures but 13 inches across; it is, however, owing to its three-legged form and the wide spread of its feet, more firm and steady than might be expected from its diminutive size. With the exception of one piece, that marked A, in Fig. 50, which is $\frac{3}{4}$ of an inch thick, it is wholly constructed of $\frac{1}{2}$ inch board. Fig. 50 is an elevation of this little table, and gives some idea of its general appearance.

Fig. 51 shows the upper side of the top with the ornamental chamfering which runs round it. As this top is not intended to have a covering of any sort, it is smoothly and neatly finished off. In choosing the wood for this top, I deviated from my ordinary rule of employing pine wood only, and made use of a piece of mahogany panel. For this I had two reasons: in the first place, I could not, at my timber-yard, get $\frac{1}{2}$ inch pine to the required width, and I could not trust my skill to make a satisfactory joint for such a purpose; and, secondly, I feared that if thus used the thin pine might warp. As it is, I was fortunate in getting a piece of thoroughly seasoned panel, and thus far it has stood admirably.

In Fig. 52 is given the under side of the top, with the under-board to which the legs, etc., are attached. This board measures $11\frac{1}{2}$ by $7\frac{1}{2}$ inches, and has its edges plainly chamfered off. It is fixed, as shown, with its greatest length crossing the grain of the top-piece, to which it is clamped from below with small flat-headed screws, and to which it thus affords considerable strength. In the middle part of this diagram is shown the arrangement of the tops of legs (one of which is marked B) and of the cross-ties (one of which is marked C,) where they come in contact with the under-board.

Fig. 53 is a working drawing of one of the legs. Each leg is 1 foot 10 inches long by 3 inches wide. In striking out the legs, the worker will find that if he makes the outside angle at top and the inside angle at bottom of about 97 degrees, he will give the proper slope outwards. These legs look somewhat elaborate, but the fact is that in so thin a material as ½ inch pine, much may be done towards shaping and ornamenting them, even with no better tool than a sharp knife, in a few minutes.

For the cross-ties (D, Fig. 50) no separate drawing is necessary; one of them is well shown in the elevation. These pieces are $4\frac{1}{4}$ inches deep, whilst their width increases from about 5 inches at top to 6 at bottom. The manner in which they are fitted to the legs by sloping off their inner sides, is seen in Fig. 52. Each tie is fixed to the legs, as shown, by small round-headed screws. In driving these some care is required. To look well, the heads on each side of the leg ought to be directly opposite to each other, and it is not always easy so to direct their points that they shall not meet. For the sake of effect, these pieces are set a little back from the front edges of the legs.

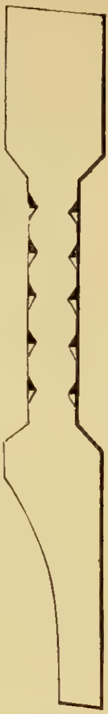


FIG. 53.—LEG OF SMOKING TABLE.

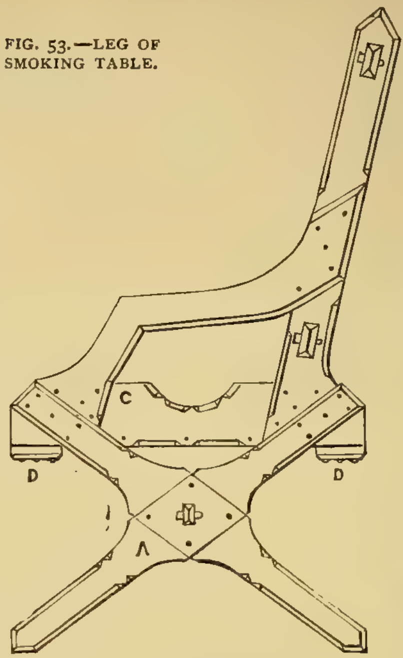


FIG. 39.—GLASTONBURY CHAIR. SIDE ELEVATION.

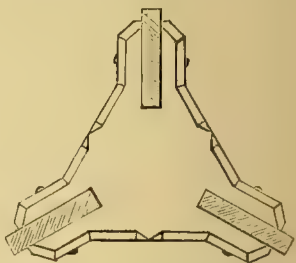


FIG. 54.—CENTRE TIE OF SMOKING TABLE.

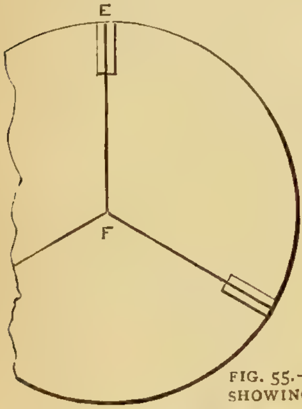


FIG. 55.—DIAGRAM SHOWING HOW TO FIX LEGS.

FIG. 51.—TOP OF TABLE.

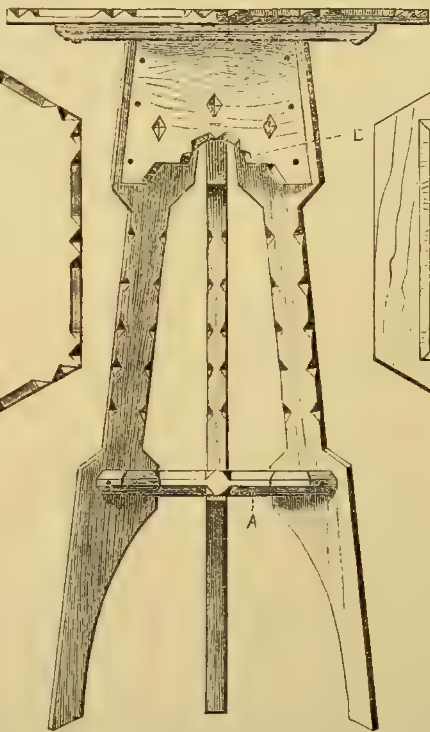


FIG. 50.—SMOKING TABLE—ELEVATION.

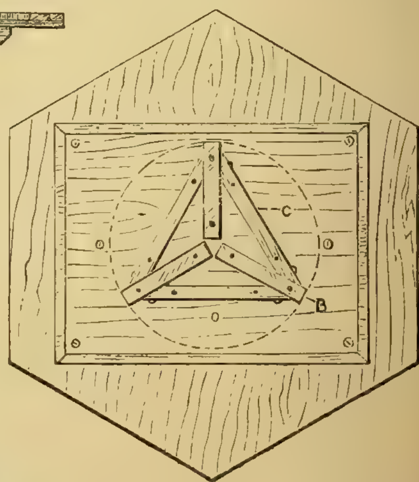


FIG. 52.—UNDER SIDE OF TOP.

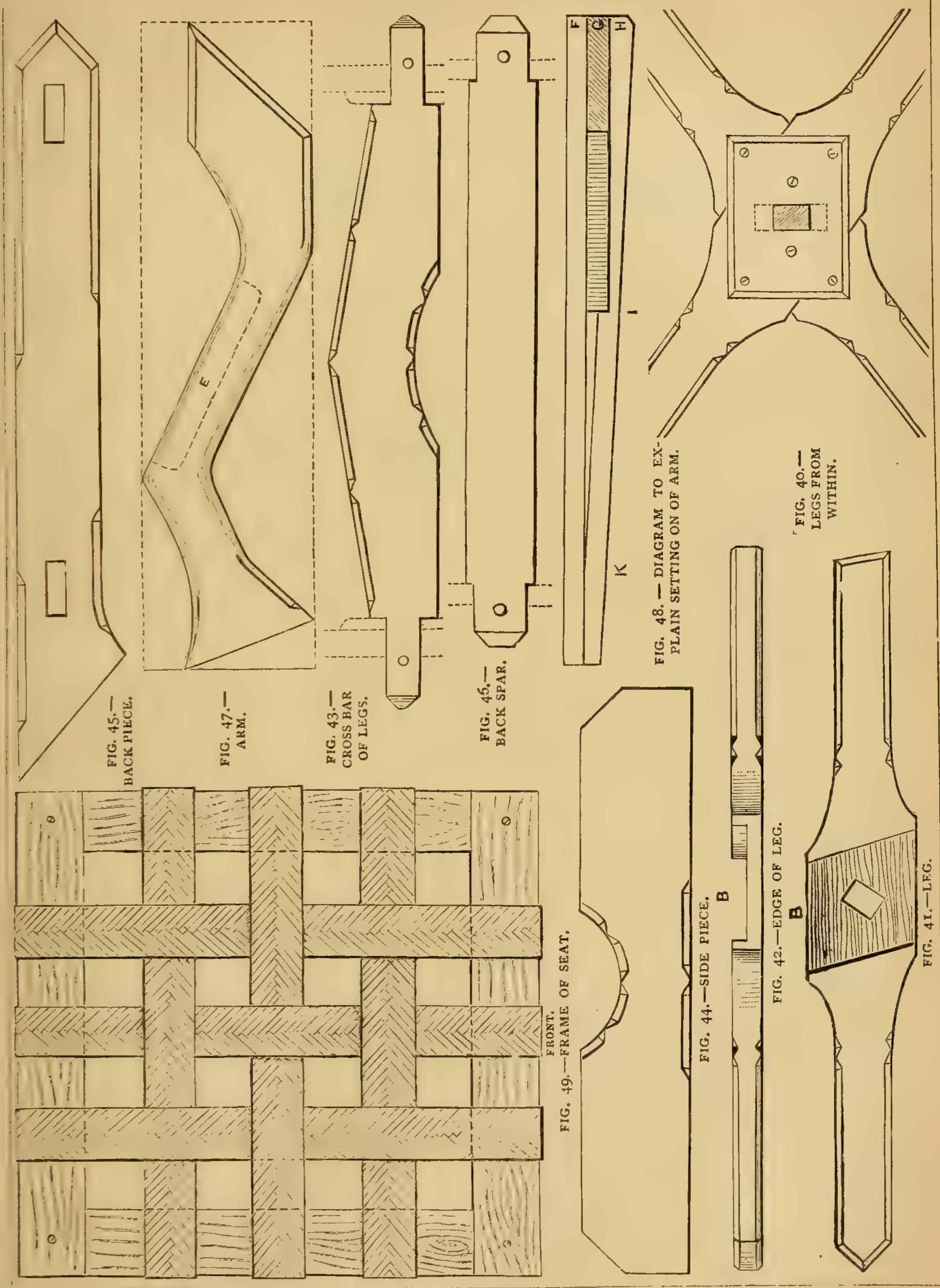


FIG. 45.—BACK PIECE.

FIG. 47.—ARM.

FIG. 43.—CROSS BAR OF LEGS.

FIG. 45.—BACK SPAR.

FIG. 48.—DIAGRAM TO EXPLAIN SETTING ON OF ARM.

FIG. 40.—LEGS FROM WITHIN.

FIG. 49.—FRAME OF SEAT.

FIG. 44.—SIDE PIECE.

FIG. 42.—EDGE OF LEG.

FIG. 41.—LEG.

Fig. 54 is the central-tie, which is marked A in Fig. 50. For the sake of strength this piece is, as before mentioned, of ¾ inch wood, instead of ½ inch, which is used in every other part of the table. I considered lightness as a point to be kept in view in this article, but a little extra thickness in this particular portion of it, makes but small difference to the weight, as this piece of wood measures 4½ in. only in its widest direction. The general shape is triangular, and it has three wings, two inches wide, in each of which is sawn a ½ inch slit to receive the leg, which is, as shown, fixed in with a couple of round-headed screws.

I gather from the letters of correspondents that some of the readers of AMATEUR WORK have found a difficulty in putting together some of my articles of furniture, of which the construction is much the same as that of the present table. It will therefore be well that I should describe my own way of proceeding. I consider what will be the radius of the circle to which the legs will extend at bottom. In the present case it will be 6 inches, so accordingly, on a suitable piece of board, or, better, on the floor of my workshop, I describe a circle with a 6 inch radius, as in Fig. 55. I then divide the circumference into three equal parts, as at E, E, E, and from these divisions draw lines to the centre, F, as shown. As my legs are 1½ inches wide at bottom, I mark off the outer 1½ inches on each of the radii, and this gives me the positions of my three legs, the places of which I then outline more fully, as in the diagram. I then fix the bottoms of the legs to the places marked with a brad or two or a temporary dowel.

Next I take my under-board of top (Fig. 52), and on its lower side find the places for the upper ends of the legs in the same manner that I before found the places for their lower ones; these places are marked in the last-named diagram. Then, through the places thus marked I bore holes for screws, and make other holes *exactly corresponding* to them as regards situation in the tops of the legs. I turn my under-board over, and drive in my screws; as they are forced home, the legs are necessarily drawn into their proper positions.

The skeleton of my table is now set up, and stands firmly, and I can adjust my cross-ties (D, Fig. 50) at my leisure; and, in fact, this is an operation which needs to be done carefully, as it is almost impossible to slope these pieces off accurately unless one has the legs in position to try them against. When they are fitted, they are secured to the legs, as shown, by round-headed screws; and two longer flat-headed screws are also driven down into each through the under-board of top. This done, the bottoms of the legs can be released, the table reversed, and the central-tie slid down into its place and screwed there. It only now remains to screw the under-board to the top-board, and the table is then completed.

By proceeding in this manner nothing can be more simple or easy than to put together any table, stool, or other article of kindred design. All the diagrams which illustrate My Smoking-Table are on a scale of 2 inches to the foot.

(*Concluded.*)

UPHOLSTERY AT HOME.

By DAVID ADAMSON.

V.—UPHOLSTERING A CHAIR WITH SINGLE STUFFING AND STITCHED ROLL (*continued*)—UPHOLSTERING A CHAIR SEAT WITH DOUBLE STUFFINGS.

WANT of space, brought about in part but not wholly by a slight going off at a tangent on my part, compelled me to leave the remainder of my remarks on tack-stitching the edge of a chair to the present chapter, so I now pick up the thread of my discourse just where I dropped it.

After the tack stitching is finished, the tacks should be driven well home, and when hammering them in care should be used not to cut the string as such an accident might happen through too forcible an application. I ought, perhaps, to say, that on coming to the end of a piece of twine when tack stitching, do not join the piece to it, but twist the ends of both under tack heads and hammer them down. In the next operation, that of blind stitching, the twine is not caught under a tack. During it, and indeed before it is begun too, the regulator should be well used to work the stuffing, which is more or less distorted by stitching, even and well up into the edge. The use of this tool is not difficult to acquire, though it is not altogether an easy matter to work it efficiently at first. The only direction that can be given about it is to push the point through the scrim, and work up the adjacent stuffing by prodding and moving it about to carry any excess of material to parts where there may be a deficiency. Though apparently simple, it will be well not to slur over this part of the work as there may be some temptation to. To form the blind stitches, or row of stitches rather, for like the tack stitches they go round the seat, and like it are not visible on top, the needle is inserted near back leg on the left hand side of the chair, but closer to the top. About midway between the wood and the edge, or about ¾ inch above the tacks is a suitable place. The needle is pushed through to the top as before, but is brought out nearer the edge, say half-way between it and the place where the tack stitch was carried to,

and then taken back to the side exactly in the way already described only on a line with the entrance. The end may be secured by simply tying it with a noose or slip knot. The needle is next put in on the same line about 1 inch or 1½ inch nearer the front, worked through the top and down again, coming out ½ inch or ⅝ inch towards the back midway between the preceding stitch and the one being formed, so that a series of them look very like a line of backstitches. Fig. 29 will explain this sufficiently. This is the simplest and easiest form of blind stitch, but with a little more trouble, a far more effective one may be made, forming, as it were, a loose knot with each on the side of the seat instead of only carrying the string forward. In carrying the stitch round the front corners care should be taken to keep these square and sharp, unless, of course, the chair is one with what are known as "round" corners—an expressive, if bullish, definition. The best way to keep them sharp is to diminish the size of the stitches as they are approached, and to form the knot just at the angle. It may be said for those who do not care to take the trouble involved in making both the tack and the blind stitches that the latter alone will suffice fairly well for a thin seat, one, for example, that is not over, or very little over, 1 inch thick. If carefully done, and the stitch made low down near the tacks, a good deal of wear may be got before the seat gets appreciably deteriorated in appearance or uncomfortable. Before putting on the wadding, which should be placed as when doing a pin-stuffed chair, the ties may be cut away. Sometimes they are left in, and there is no objection to this unless they have been pulled so tight as to form hollows when they should certainly be removed, or at least loosened. The wadding should be put on the top of the chair only, and not hang over the sides down to the wood. The covering hardly needs any special instructions after what has been said. It should, of course, be drawn and tacked over evenly, its edge coming down to the moulding which runs round most chairs. The space for the back leg must be cut like the Hessian, but not quite so far, and the edge carefully turned in, cutting away a little if a neater finish can be made by doing so. At the back it will be better to work the loose pieces in between the ends of the slip of wood and the legs. At the front corners it will be necessary to fold the covering into a pleat to preserve the squareness, and this should be done carefully, otherwise it will look clumsy. The fold should be made under, on the front, not on the sides. Fig. 30 by the dotted lines shows the direction of the fold, the double lines on the left would not be seen so clearly, if at all, on the actual seat, but they are here introduced to show the pleat distinctly. Fig. 31 explains the fold more fully, the covering being represented as loose, not yet tacked down. The angle of the fold, as roughly indicated by the cross lines, may often with advantage be cut away, and a neater finish will result. If the covering be a soft one instead of folding under, the corners may be sewn up, and with a suitable material, this is, perhaps, a neater way, especially in the hands of an amateur, though some upholsterers object to it. It should not, however, be attempted if the covering is hard and thick.

Seats with single stuffing are not suitable for buttoning, if by this is understood the system adopted when the buttons are deeply sunk, and the covering pleated, as is generally the case when they are used. For example, look at an ordinary buttoned leather covered couch, or, perhaps, it would be better to refer to the scroll or head of one, as this part is frequently buttoned even when the seat is plain. Single-stuffed seats may, however, be buttoned, or to express it more correctly be starred with buttons—much in the same way that mattresses, loose squabs or cushions of old-fashioned sofas, pew cushions, etc., are tufted or buttoned. The buttons are on the top, and the seat is only slightly indented or starred. A special kind of button is used for upholstery purposes, flat and covered either with the same or similar material as that used on the chair seat. This, however, is not an invariable rule, but the amateur will do well to regard it as such, if he can get buttons and covering to match. The buttons on a single stuffed seat will have, of course, the effect of flattening it, so that if it is too rounded or high in the middle to look well, they may be used with advantage. The usual number of buttons on a chair seat, unless in the case of fancy buttoning, is either five or ten. The arrangement of these respectively is shown in Figs. 32 and 33, which need no explanation. The mode of fastening is to run the needle up from the bottom through the seat, thread a button and push the needle down so that it comes out close to where it entered. Don't pull the string tight till all the buttons are placed, but as each is stitched to the seat cut the twine, leaving a few inches hanging down, tying so as to make a slip knot which can be drawn tight afterwards. The object of not fastening each button as it is sewn is that, were this to be done it would be more difficult to draw them equally. With a slip knot to each they can be drawn down gradually and regulated, and when properly adjusted fastened by tying permanently. More will be said about buttoning later on in another chapter, but I must leave this for the present in order to describe the upholstering of a chair with two stuffings.

I suppose it is almost unnecessary to say that the edge of the covering where it is tacked down should be finished off with gimp or banding. This latter,

however, will be more fully considered in the following part of this chapter.

In the best work the class of chairs mentioned in the last article of this series, where the method of upholstering them with a single stuffing was described, are done with two stuffings, the first of which serves principally as a support to the second. When properly done, double stuffing is undoubtedly superior to single, and a seat so stuffed may almost be taken as a counterpart in upholstery to a drawer in cabinet work. It forms a very good criterion to go by in estimating the general skill of the worker. It is a little too much to say that anyone who can form a good plain seat with two stuffings and stitched roll can do anything in upholstery, but unless a strictly accurate and mathematical definition is attempted, it is not far wrong. Knowledge how to do other kinds of upholstery, or how to upholster different varieties of seats may be absent, but it can be acquired; and I don't think any greater difficulties in doing the work will be encountered than in upholstering a seat in the way now described. So don't be discouraged, you who are discovering that there is some art in upholstering, and that to stuff a seat properly does not merely consist in putting on a soft pad and covering it. I fancy very few not intimately connected with upholstery have any idea that there is so much method and technical knowledge required over such an apparently simple thing as an ordinary chair seat. Possibly some of my readers may begin to understand now that there may be some difference in the stuffing and the way it is worked, which is not seen when the covering is once on, although I have not, nor as I said in a previous paper, do I intend to describe how the commonest class of work, the rubbish, in fact, is done, although, like someone else who said in conenctoin with another subject, "I could a tale unfold." The difference in price between a chair at 80s. and one at 30s., is not all profit, however little the "knowing" enquirer may think the two differ otherwise, unless he has some practical acquaintance with the subject. Probably no work affords such opportunities for scamping, opportunities that are not neglected. For a double stuffed seat, the upholstery, up to a certain point, is the same as described for one with single stuffing, the chief difference being that it has an extra stuffing between the first and the covering, so that it is not necessary to recapitulate the instructions for webbing, canvassing, etc., which are done exactly as described.

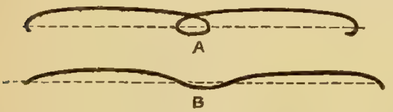


FIG. 35.—STRINGING.
A, Right Way; B, Wrong Way.

The first stuffing is also done as before, or very nearly so; but as the differences are merely comparative, it is not easy, on paper, to describe them exactly. It may suffice to say that the seat, till after the first stuffing has been completed, should be kept tolerably flat, and that in working the hair up under the scrim, before tacking down, care should be used to make the edge firmer than necessary in the case of a single stuffed chair. I must not omit to say that the scrim also should be left a little fuller. When we come to the stitching, the most important difference occurs, for there is no blind stitch. Instead of this the top stitch, as it is called, is worked after the tack stitch. Those who have followed the instructions in the last article will have no difficulty in understanding the top stitch, which is very similar to the blind stitch, only that it shows on top, holding down the scrim as well as the stuffing. Fig. 34 represents a chair seat, with the first or bottom stuffing finished. On the top will be noticed, near the edge, two rows of stitches. By the way, I should say, in order to prevent confusion, that this chair, of which the illustration is taken from a photograph, had two rows of blind stitches—one of them, the lower, having been made instead of a tack stitched row. Had the tack stitch been used it would not have been seen, so that only one instead of two rows of stitching would have been visible on the flat edges of the seat. I have endeavoured to show by the black dots the rows of the first top stitching. Now, as the chair from which the photograph was taken was upholstered by an excellent worker, we see that the rule for tack stitching first is not always attended to, even in the best class of work; but the amateur will do well to leave the blind stitch alone when he can make use of a tack stitch. The top stitch should be on the seat, about 1½ in. from the edge. Now start a second row, still nearer the edge and with smaller stitches, ½ in. apart will do very well. Though these stitches on front and side do not appear on the illustration, it is merely because they are hidden by the roll formed by them overhanging a little. The regulator must be freely used when top stitching, especially before making the second row, in order to work the stuffing well up to the edge. When the stitching has been finished, tacks holding scrim should be driven home firmly, and the ties on top removed. Then, again, the ties shown in this illustration are different from those described; as it will be noticed, the scrim is held down in eight stitches instead of four, so that the amateur will see he has good authority for using whichever number of them he may prefer.

We are now ready for the second stuffing, and whatever the first was, this certainly should be hair. The operations of second stuffing very much re-

semble those of pincushion seating, the first stuffing being the foundation, so that it will not be necessary to treat of them at any great length. Still there are differences, and these require attention. There should be at least three stringings from back to front, that is, one on each side and another in the middle. The circular needle will be necessary, as owing to the first stuffing the ends could not be held down by tacks. The stringings should not come nearer than a couple of inches to the edge, so making a start, say, with the centre stringing, put the needle in at this distance from the back, securing the end in the middle of the chair; pass the needle in under the scrim backwards so that it comes out a little nearer the back, then take it over to within about two inches from the front of the chair and fasten down. The reason of the needle being worked backwards at the centre is that the hair can be worked close up under each part of the string.

Fig. 35 will, I think, show this clearly; A representing the correct plan, and B the wrong one. In the latter it will be seen that the hair could not so well be distributed without leaving a hollow where the stringing goes under the scrim. The stringings (one more or less of them will not signify) being ready, the hair must be worked under them evenly, well spread, and not too thickly. Take care not to let any hang over the sides, but keep it well on top, but as close to the edge as possible, and do not make too much of a swelling towards the middle. When this is done, a covering of calico, or almost any other light, thin material, should be put over. Tack this down temporarily like the scrim, and smooth it over when fixing permanently as in the direction for pin stuffing. Of course, it must be cut like the scrim under it, to fit the back legs, and neatly fitted at the front. The tacks should be about the centre of the rail—that is, midway between the row holding the scrim and the moulding of the seat. It is necessary to drive the tacks well home to prevent the heads appearing through the outer covering which should be put on above wadding as before. It is fastened down exactly as if the seat had been finished with a single stuffing. Reference has been made to the use of banding instead of gimp. If the chair has been well upholstered, and a fair degree of success attained, the amateur need not hesitate to cover it with a good material. Should it be leather or velvet then, instead of gimp, use banding, which consists of leather strips turned over and generally tooled to give a finish. Banding can hardly be satisfactorily made by the amateur, but it is cheap and easily obtainable from or through any upholsterer, to whom, as a guide for colour, a piece of the covering should be given. Leather covered, or as they are liked by some, brass studs should be used to fix the banding instead of gimp pins. Brass studs are, however, not so much used as formerly, except in drawing-room chairs, and when used plain round-headed studs look better than the elaborate fancy productions which were in vogue a few years ago. As studs have soft weak shanks it is necessary to bore holes before inserting them.

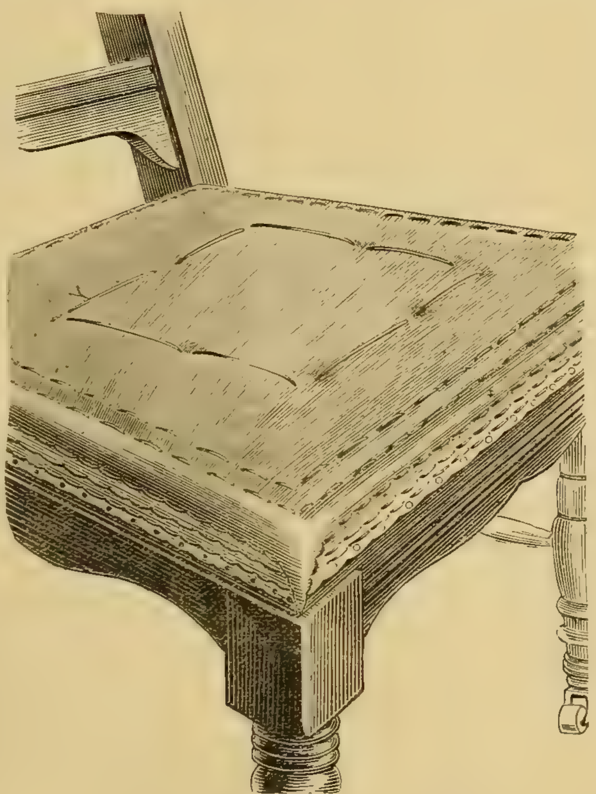


FIG. 34.—CHAIR SEAT FIRST STUFFED.

It is possible that Fig. 15, showing "four arrangements for brass studs round old chairs" (page 417) may cause confusion in the minds of some readers, as the idea conveyed, though clear enough to those whose previous knowledge shows them what is intended, is hardly explicit enough for others. The first two especially look as though diamond shaped and oval studs of large size are intended, the engraver having misinterpreted the sketches from which he worked. If the upholsterer will imagine each thick line, including the outer lines, to be a row of studs driven in close together, in the same way as the two rows shown in Fig. 14, I do not think there can be any misapprehension.

(*To be continued.*)

PURE REPOUSSE WORK,

AND HOW TO DO IT.

By LANCELOT L. HASLOPE, Author of "Repoussé Work for Amateurs."

III.—Beating out Work from Back—Tools for Raising Metal—Mode of Using Them—Modelling—Finishing and Lacquering—Hollow Work—Pierced Work.

WE now come to the most interesting, but, at the same time, the most difficult part of our work; that is, the raising or beating it up from the back. The plate, after it has been chased and cleaned, will have to be laid face downwards on the pitch, in the same way as when it was made ready for chasing; as the strain on the brass will be greater now than during the chasing, it is desirable to secure it by working the pitch some little way on to the back of the plate, overlapping the edges, and so preventing the work from springing off the pitch. If the design contains fruit or other large surfaces that require raising, it is as well to work these up a little before the pitch is quite cold, but care must be taken not to go too far, or the effect of the work may be spoiled; it should only be slightly raised in the parts that are to be highest, or "bosted out," as a carver would term it. All the more delicate parts of the raising being left until the pitch is cold.

Independent of the difficulty that the beginner will find in moulding the metal into the shape he requires, is the still greater one of not being able to judge of the effect that his blows will give to the face of the work. A plaster cast taken from the face of a similar piece of work will be of great service to him here, and should be obtained if possible. There is so little apparent resemblance between the front and back of a piece of repoussé work that it is very puzzling to a beginner. I have seen some designs stamped in relief on cardboard that would be very helpful at first. They were published in Paris, but could doubtless be obtained in England. The material being so thin, the back and face can be readily compared with one another, and the difference between them noted.

In flat chasing, the outline is cut of nearly an even thickness throughout, but this is not the case when it has to be raised; the outline is now made stronger round the parts to be raised the highest, and lighter where the shallower parts of the design come in. This will be of great assistance when the plate comes to be beaten up, as in itself it gives some degree of form to the work, and makes it easier to raise the different parts in due proportion.

The tools required for raising are very different to chasing tools. They are as a rule larger, that is, thicker and more or less rounded at the ends; they are also sometimes made of brass, particularly the larger sizes. The same length as advised for chasing tools, that is, about four inches, will, on the whole, be found the most convenient for these also. The tools that I find I use the most are those with oval ends and slightly convex faces. These range in size from half an inch to less than one-sixteenth of an inch on the face; several sizes should be kept in stock. Next to these in point of usefulness are the round-ended tools, some of the larger sizes of the ball tools are also very suitable for beating up, and are much used. Fig. 1 is a tool with the end somewhat like a flattened ball, it is handy for raising large surfaces that have not much modelling in them, such, for example, as oranges and plums, or for the first raising of large spaces to be modelled afterwards with smaller tools. I have two sizes of this tool, the largest being 1 inch and the other ¾ of an inch across the face. Fig. 2 represents another very useful tool, the face is longer than it is wide, and rounded off each way. I use it a good deal for working up the stems of trees and a great variety of other purposes. The largest size I have is nearly half an inch the longest way, and the smallest one-eighth of an inch. These tools may be considered as typical ones for the back of the work, though others of slightly different forms are occasionally taken in hand. I may say here that it is very desirable to keep the different sorts of tools separate, so that each may be found without delay or trouble. Fig. 3 shows the toolholder which the professional chaser uses; it is made of tin, about two and a half inches high and one and a quarter inches in diameter. Any handy amateur can make them for himself as his stock of tools increases.

The same form of hammer is required for beating up as was used for chasing, except when the tools are heavier, when a somewhat larger one may be used with advantage; at the same time, I must guard my readers against being too rough and precipitate. It is much better to attain your object by a number of light blows than one heavy one.

The forms that the metal is made to assume in repoussé work are so various that it is impossible to lay down definite rules to meet all cases, but I will endeavour now to describe, as well as I can, how the work in general is carried on. It must be remembered that the plate is supposed to be finished when the process I am describing is completed, and that there is to be no modelling or working over the face afterwards; consequently, care must be taken not to raise the metal higher than it should be, as there will be no opportunity of altering it afterwards. When the plate is reversed after chasing, it will be perceived at once that the outline is quite visible on the back; this

must, of course, be carefully preserved, as it is all the workman has to guide him. This is not always quite easy, particularly when there is outline within outline, and the inner one has to be raised higher than the outer one. Take, for example, a leaf or branch crossing a fruit, it would not do to beat up the fruit first, as the outline of the branch would be obliterated, but the branch must be worked at until it is well raised, and the fruit may then be proceeded with until there is danger of smoothing out the branch—this should now be raised again. This order of things must be repeated until both branch and fruit are in their proper relative positions. It is better, I think, to raise the whole of the design by degrees than to complete each part separately, as it is easier to judge of the effect if it proceeds gradually, and there is less danger of getting any part out of proportion to the rest of the design. The main outline should be specially cared for, and none of the beating must extend beyond it into the ground which surrounds it.

When a sharp relief is required—that is, when it is desired that a part of the design, say a leaf, should rise abruptly from the ground—it is a good plan to run a line with a thick tracer just inside the original outline previous to beating up the leaf. This, if cleverly done, will produce an excellent effect on the face; the edge of this line should be softened down into the other raised parts. Fig. 7 is an illustration of this, and represents the section of a leaf thus treated—A is the ground of the design, B the leaf, and C the edge, raised at right angles with the ground by the method I have just described.

The beating tools are seldom traversed along as the tracer is, but they are generally used with a sort of stroking movement, beginning at the deepest parts and working towards those that are shallower. The blows of the hammer are light and rapid as in chasing.

The oval tools, and tools like Fig. 2, are often made to revolve on one end, the other parts of the tool circling round it, and so *rounding out* the metal underneath—of course, the hammer going rapidly all the time. Indeed, the tools are applied at every angle and in every manner that the workman thinks will effect his purpose; but they are almost invariably kept in motion, single blows on a stationary tool being very rare. Of course in this part of the work everything depends on the skill and taste of the workman. In chasing he had the outline on the metal to guide him, but now he has to trust solely to his knowledge of modelling for producing an artistic result. Amateurs often chase correctly, and even beat out their work smoothly; but there is too often an almost complete absence of modelling. All parts are rounded up alike, and there is a want of that contrast which gives so much beauty to good work. Great pains should be taken to avoid this, and the workman should have a clear and definite notion of the effect he intends to produce before he attempts the execution of it. Every effort should be made to render the work as truthful as possible. To do this he will do well to study nature at every opportunity. He will also be amply repaid by a few visits to the South Kensington Museum, which contains very beautiful specimens of metal work.

If on taking up the plate any parts are found not to be raised sufficiently, it must be laid down and worked over again until it is considered satisfactory. It may now be cleaned as already described, "set" or straightened, and it will be ready for lacquering and mounting.

We now come to the last process of all, which I have termed "modelling." The chasing and beating-up are supposed to have been completed, but it is desired to give a more finished appearance and greater artistic value to the work; in other words, to turn it out as well as possible. The plate having been "set" and cleaned, fill all the hollows with pitch, either by melting some in a ladle and pouring on to the back of the plate, or by putting some small pieces of pitch on to the plate, and melting it afterwards. As soon as the pitch has set, warm the face of the block and lay the plate on to it, taking care that it adheres perfectly all over. As the work is light, there is not so much necessity to have an edging of pitch on the face as there was when the plate was beaten up, particularly if the pitch be soft and tenacious. The work must be allowed to cool before anything is done to it. With a blunt tracer go round the outline and level down any part that has been raised too much. Then with a square-ended flat tool, smooth down the ground round the design; this of itself will sharpen up and improve the work greatly. Now work over every part of the plate that you consider can be improved, beating down parts that require it, and sharpen up others by working round them; in fact, modelling the whole in the most artistic manner possible. This process has one great advantage over the preceding one, inasmuch as the work being face upwards, the workman can see where the blows are required and judge exactly as to the effects of them. Still it is undeniably difficult, and will need considerable practice before the amateur becomes successful at it.

The directions for this part of the work must necessarily be very meagre, as it is impossible to give anything like specific instructions where the effects to be produced are so very various. This part of the process is strictly modelling in metal, and it cannot be properly described in words. The best way for anyone who thinks of attempting it is to take a lesson

before commencing, or if this is impracticable, the next best thing is to procure a piece of good work and to copy it to the best of his ability. One difficulty the workman will meet with at the outset, and that is what to do with his tool marks, as a punch cannot be used on metal without leaving marks of some kind. This brings me to another part of my subject, and that is delineating the texture of various substances. The marks made with the tools should not be erased with emery or a burnishing tool—both of which methods an amateur will feel, most probably, strongly inclined to try, particularly where he wishes to leave his work smooth, or nearly so, as the face of a figure. Instead of doing this, he should, with a smoothing-tool, gently and carefully work over the different parts, giving very light blows to the tool, which must be moved along in the direction of the muscles, veins of leaves, folds of drapery, etc., this, while assisting the form, will also give the appearance of texture to the various substances represented. The marks of the tools should always remain (as in carving) when the work is finished, and they should be so made as to give the right textures to leaves, hair, drapery, and even flesh. Texture tools are very various, and it is impossible to give an illustration of them, as the markings on them are usually too small and irregular to be properly represented in a woodcut. They are also frequently traversed broadside on over the work, which gives an effect totally different to what the pattern on the tool would lead you to expect. Sometimes the work is first modelled with smooth tools, and the texture added afterwards ; this is generally the case where much modelling has to be done, and at other times the modelling and texture are done together. As in painting and all other arts, different artists use different means to attain the same end, everything here depends on the artistic perception and skill of the workman, to be gained only by long practice. I can, consequently, give but little advice as to what tools are to be used ; but I may say generally that every kind of tool comes in for working over the face at some time or other—the size used being generally smaller than for raising. Flat-ended, or smoothing tools, are much in request for levelling down the ground and other parts that are required to be flat, and oval tools on surfaces that are more or less rounded.

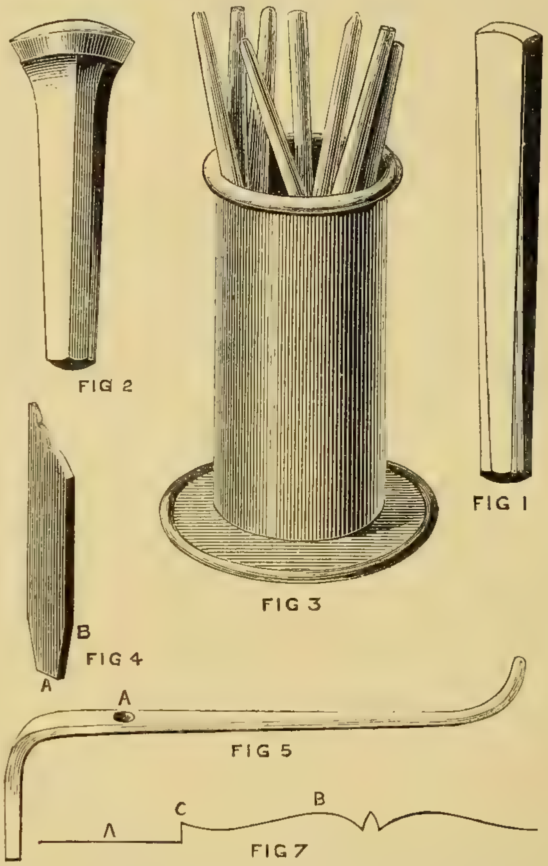


FIG. 1.—BEATER. FIG. 2.—BEATER. FIG. 3.—TOOL HOLDER. FIG. 4.—MODELLING TOOL. FIG. 5.—SNARLING TOOL. FIG. 7.—SECTION OF LEAF.

A very useful tool is represented in Fig. 4. With the aid of this, the edges of the design may be made to rise perpendicularly to the ground, or be even undercut if desired, as in the case of a leaf which curls over at the tip. When it is intended to make use of this tool, a line should be cut on the back, inside the original outline, as I have already described. It is desirable to have two, if not three sizes of this tool. In using it the lower surface, A, should be kept flat on the ground, and the front, B, be pressed against the edge of the design, the tool being worked at the same time along the parts to be dealt with. By repeating this process, any amount of sharpness required can be easily obtained, as at C, Fig. 7, particularly if the surface of the leaf be hollowed out to meet the raised edge.

When the modelling is satisfactorily accomplished, and the proper texture put in, the next thing is to work the ground over with a suitable mat, after which it may be taken up and cleaned, when it will be ready for finishing and lacquering.

The best method of finishing plates that have been worked after the manner I have just been describing, is to dip them in dipping aquafortis for a second or two, then wash thoroughly in two or three waters, and dry in sawdust, then "sand" it carefully, brush all the sand off, and dip again. Now scratch-brush it well, either by hand or with a brush running in a lathe,

moistening the work at the same time with a solution of half an ounce of cream of tartar in half a gallon of water, dry in sawdust and lacquer with dark amber lacquer. This produces a beautiful dead appearance, which is very artistic, and does full justice to the work; it is much preferable in my estimation to a very bright polish, which, when hung against the light, reflects other objects like a looking-glass, and where the relief is high, spots of light catch the portions that are raised the most, and spoil much of the effect.

Hollow work has in some respects to be treated differently to flat plates. The chasing is done in the same manner, but as it is impossible to do the raising with a hammer and punch, other means have to be resorted to. Fig. 5 is a "snarling iron," made out of flat iron 1 inch wide by ¼ inch thick, and about 14 inches long, exclusive of the part held in the vice. If the work be of moderate size it can be held in the hand, with the spot to be raised resting on the point of the snarling iron; if the point, A, be now struck with a hammer, the iron will rebound and give a blow to the metal sufficient to raise it in proportion to the weight of the blow given. By a succession of blows it is evident that the metal can be beaten up to the required height. Of course, this method is a somewhat rough one, and very great nicety being impossible, the work must be modelled over on the face after the raising is finished. Sometimes the end of the snarling iron is formed into a socket, into which different heads, varying in size, can be fixed, but the tool is such a simple one, and so easily made, it is the readiest plan to have several of them of different sizes. About half an inch across the head is the largest size the amateur is likely to require. If the work to be "snarled" is large, it is necessary to have an assistant to strike the iron while the workman holds the article to be raised with both hands. The ordinary chaser's hammer is too light for this work, and another hammer, about the weight of a carpenter's full-sized hammer, will have to be provided. As in all the other processes I have described, care will have to be used and light blows given, the result being carefully watched after every blow. After the snarling is finished, the article must be filled with pitch and fixed on to the place where it has to be worked, generally the chaser's bowl.

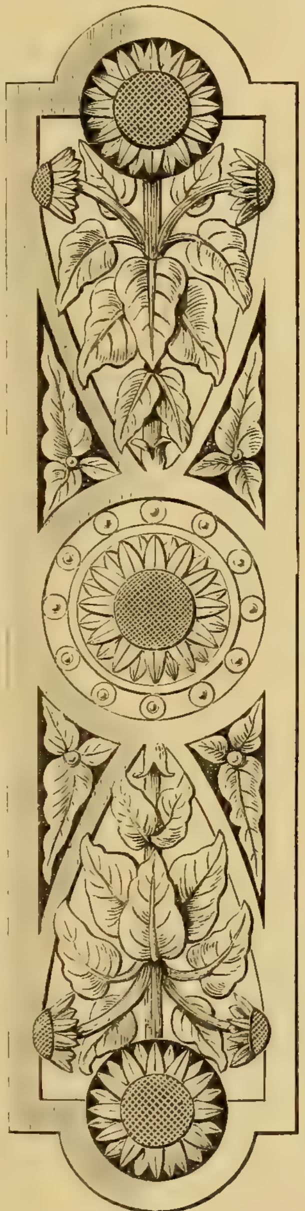


FIG. 6.—FINGER PLATE IN PIERCED WORK.

Lead is occasionally used to fill the article which has to be snarled when deep flutes have to be worked over. This is melted out when the work is finished, but I think the amateur will find that pitch is easiest to manage, and will suit his requirements best. In all the processes I have described, there is some little danger of cutting through the metal, it may also break if it has become very hard by much hammering, this can always be avoided by annealing the plate if it requires it. The workman must be very clumsy to cut through the metal, but I have seen it done. Should either of these accidents happen, the work may be made good by soldering the faulty place with soft solder. To prevent the solder appearing on the front of the work the face should be covered with plaster of Paris. Before soldering, the edges of the crack are to be brought close together, a few gentle taps with a suitable punch will soon effect this.

What is called "Pierced Work" is another way of finishing off repoussé work. This is generally applied to flat plates, though it is occasionally used on hollow work or curved surfaces, such as cake-baskets, etc. The articles are sometimes only chased before they are pierced, and at others they are raised as well. Whichever method is adopted, the work must be completed up to the point when the matting would have been put in; instead of doing this, the ground of the design, or portions of it, are removed with a "piercing saw." This is very similar to an ordinary fret-saw, the main difference being that it is smaller and that there is a special method of giving due tension to the saw-blade. It is used precisely in the same way as a fret-saw. The saw is first unclamped, then inserted in a small hole drilled in the part to be removed, and afterwards secured again. The

saws for metal work should be much finer than are required for wood, and the teeth should be so fixed that the saw cuts when it is pulled downwards, and not when it is pushed upwards.

Silver work looks extremely rich when it is pierced, and great charm may be added to a variety of work by piercing it more or less. A pierced border, for instance, looks well round a solid centre or round the edge of baskets or trays.

Fig. 6 shows the effect of pierced work on a finger-plate for a door, the ground being only partially removed. The saw should be strained very tight, and care must be taken to work it vertically, or the saw will soon break. I have omitted to mention an appliance the repoussé worker cannot well do without, and that is a buff board. This is merely a piece of buff leather glued on to wood. To use it, put a little crocus on the leather, and rub up the tools on it. The face of the tools should always be kept bright, though the edge is almost invariably blunt.

In the foregoing pages I have endeavoured to give my readers as clear a description as I could of the method of working thin metal *en repoussé*. My knowledge of the art has been acquired in the studios of some of our best artists in metal, to which I have been fortunate enough to have had access for some years, and my readers may therefore feel confident that if they bring ordinary ability to bear on the work, and follow the directions I have given with painstaking perseverance, they will be rewarded with a large amount of success. Of course, artists, like poets, "are born, not made," and the highest branches of the art are therefore beyond the reach of ordinary mortals; still, I am convinced that nothing better repays the time and trouble given to it than pure repoussé work conducted on proper principles.

My readers need not trouble themselves with any attempts to thicken the plates by moving the metal from one part of it to another with blows of the hammer, or they will most assuredly get themselves into difficulties from which they will not readily escape. Abundant relief can be obtained without doing anything of this kind on a plate the thickness that I have recommended. In pure repoussé work the metal is never touched with the hammer itself, a tool of some kind *always* intervening. Indeed, though perfectly adapted to its own legitimate work it would be difficult to find a tool less suited to what one may call forging metal, than the professional chaser's hammer, which except in "snarling," is the only one he ever uses.

Old writers, I am aware, speak of "gathering up" metal on various parts of their designs, but the whole of the instructions they have left us are so indefinite and unsatisfactory that it is difficult to make out what they really mean, and quite impossible to derive any practical benefit from their perusal; it must also be remembered that they worked under conditions entirely different to those of the present day.

When discussing Mr. Gawthorp's designs in my next article, I shall hope to give some further details as to the practical working of the different processes, which I could not well do until my readers had the drawings before them.

(*To be continued.*)

HOW TO MAKE A SMALL ELECTRO-MOTOR.

By GEORGE EDWINSON.

SOME explanation, respecting the delay in the publication of this paper, is due to those readers who are interested in this subject, and have long ago expressed a desire to see it treated by me in these pages. All correspondents who have written to me, or to our Editor, on this subject, have so fenced around their requests with conditions as to make it almost impossible for me to fulfil them. They all want to know how to make a good cheap electro-motor, suitable for driving a lathe by power derived from a battery. Now the three qualifications above mentioned, viz., good cheap electric force, is at present impossible of attainment by means of chemical action in a battery; therefore, when enquirers demanded of me a description of a motor to utilize electrical force obtained under those conditions, I could only reply that I could not do so, for my small experience of such motors had shown me that power thus obtained is always costly and troublesome. Not caring, however, to base my objection alone on my slender experience, backed though it was by most powerful theoretical reasons, I wrote to two practical makers and vendors of electric machinery, and from them I received the following replies:—"Dear Sir,—If I wanted to sell you 40 lbs. or 50 lbs. of wire, and castings to the tune of 15s. to 30s., I should say 'make a motor by all means;' but with zinc at 4d. lb. I cannot conscientiously recommend a large motor for lathe work, except under very special circumstances where neither steam nor gas are obtainable." "We shall be pleased to lend you any motors we have, but we do not find any of them a great success, believing that there is not one, after all, that is better than a toy." These replies would seem to be contradicted by the splendid results obtained by Messrs. Ayrton and Perry in their system of telpherage; by Mr. Reckenzaun in his electric launch; and by other noble experimentalists, who have not spared skill or

expense to make their motors successful wonders. But it must be borne in mind that these gentlemen never attempted to utilize in their motors the electrical energy generated in voltaic batteries. They knew this to be too costly, and therefore turned their attention to the cheaper source of power obtained by burning coal, and represented by the steam engine working a dynamo-electric machine. Mr. J. I. Sprague, in his valuable work on Electricity, estimates that $10\frac{1}{4}$d. worth of coal in a common steam engine will do as much work as 25s. worth of zinc consumed in a battery in working an electro-motor. Professor S. Thompson also in his excellent treatise on Dynamo Electric Machinery, says: "A voltaic battery wherein electric currents are generated by dissolving zinc in sulphuric acid, is a very expensive source of power. To say nothing of the cost of acid, the zinc—the very fuel of the battery—costs more than twenty times as much as coal, and is a far worse fuel; for whilst an ounce of zinc will evolve heat to an amount equivalent to 113,000 foot-pounds of work, an ounce of coal will furnish the equivalent of 695,000 foot-pounds."

Considerations founded on such facts as these prevented me responding earlier to the wishes of those readers who wanted an electro-motor to drive a lathe with power derived from a voltaic battery. I now respond in such a manner as will, I hope, convince them of the inutility and impracticability of further encouraging the thought that such a motor can be obtained. Only those who have experienced the intolerable trouble and mess of maintaining a large battery in working order, can form any idea of the actual dirty drudgery, plus expense, involved in furnishing motor power to drive a lathe from this source. A small gas engine, or a water motor, is in every way preferable where a model steam engine cannot be used.

Another class of enquirers have desired to know how to make a small electro-motor, from the sole motive, apparently, of making themselves practically acquainted with the little machine and getting amusement from the practice. With such I am in entire sympathy, and have much pleasure in assisting them by illustrating and describing a very small electro-motor of a good type and simple construction. This machine is not hampered with patent rights, and may, therefore, be made by any person having the necessary skill, time and money. The cost need not be large, however, as will be seen.

In a paper on "How to Make a Small Dynamo-Electric Machine," published in AMATEUR WORK, Vol. III., I told my readers that a good dynamo would also make a good electro-motor. The dynamo I then described has been run as an electro-motor, and it will be seen that the motor I now illustrate and describe bears a very close resemblance to that dynamo. The same principles must also be accepted as guides in the construction of this machine, the most efficient motor being that one which is best made from an engineer's or machinist's point of view, all electrical conditions being fulfilled. Every part should be well made and fitted, true and accurate in every respect.

An electro-motor, like a dynamo-electric machine, is made up of :—1. The Field Magnets, F, M, Fig. 1. 2. The Armature, A, Fig. 2. 3. The Commutator, Fig. 3. 4. The F. M. Coils. 5. The Armature Coil. 6. The Brushes. 7. The Frame, etc.

The Field Magnets.—This is abbreviated to F. Ms. for convenience. These are the electro-magnets of the machine. They are usually made of malleable cast iron, well annealed, but may be forged out of wrought iron. The shape varies with the designs of the maker. It will be seen that those of this machine have somewhat of a horse-shoe shape, and are similar in this respect to those in the motor designed by Professor Thompson. The magnets are cast in one piece, but I have shown them in Fig. 1, as cast in two pieces, then fitted together and fastened with iron pins. This must be taken merely as a suggestion to those who may find a difficulty in making the casting or forging in one piece. The dimensions are, as shown on sketch, viz. : length over all, 3 inches ; breadth over all, including lugs, $3\frac{3}{4}$ inches ; height from base to crown of arch, $3\frac{1}{2}$ inches ; breadth across arch at widest part, $2\frac{1}{2}$ inches ; length of arch, $2\frac{1}{4}$ inches ; thickness, $\frac{1}{4}$ inch ; breadth across widest part of armature space between F. Ms. $1\frac{9}{16}$ inch ; breadth across the same at narrowest parts, 1 inch ; holes in lugs, $\frac{1}{2}$ inch. I have shown the arch of the F. Ms. as $\frac{1}{4}$ inch in thickness, and with sharp corners ; these must be rounded down nicely, for they would cut the wire covering if left like this, whilst winding on the F. M. coil. The arch is also left shorter than the poles of the F. Ms. to provide a space at each end for the coils of wire. The holes in the lugs at each side are for ebonite or boxwood-bushes to hold the brush-holders, as shown at Fig. 3. The hollow space between the F. M. poles must be nicely and equally curved and made perfectly true and smooth from end to end, as this will be the chamber in which the armature will work, and it is important that the faces of the armature should work close to the cheeks or poles of the F. Ms. These will be firmly fixed to the brass frames, Fig. 14, by screws passing up through the frame at M, M, M, M, into the under side of the F. Ms. It will be well, therefore, to drill and tap these holes for the screws, and to do all necessary filing, then give the arch a good coat of shellac varnish, when it will be ready for the F. M. coil, the winding of which I will describe further on.

The Armature. — This is the part which revolves, and converts electrical into mechanical energy. Its shape also varies in variously designed motors. The shape herein sketched and described, is that known as the Siemens H armature. It may be made of wrought iron forged, chipped, and filed to the proper shape, or of malleable cast iron, as shown at Fig. 2, and of the following dimensions: Length, $2\frac{5}{8}$ inches; extreme width across ends, $1\frac{1}{2}$ inches; length of web, 2 inches; breadth of web, 1 inch; thickness of web, $\frac{3}{8}$ inch. The web or core of the armature, is the thin bar which forms the centre, and around which the coil of wire is wound. This must be smoothly rounded at the ends to prevent abrasion of the wire covering whilst this is being wound. Whether the armature is made of wrought or of cast iron, it must be turned smooth and true from end to end, and the faces must be rounded to form segments of a circle $1\frac{1}{2}$ inches in diameter. After this has been

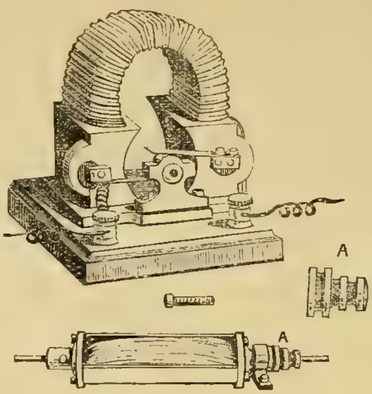


FIG. 15.

done, run a tool around the end edges of the faces, and take an angular cut in them $\frac{1}{16}$ inch in depth. This cut will just receive a corresponding flange, turned on the outer edges of the brass end-pieces, as shown at Fig. 4, and will afford a better grip of those on the armature. Two screw holes, $\frac{3}{8}$ by $\frac{1}{8}$, must also be drilled in each end, as shown at Fig. 2, and these tapped to receive the screws which hold the brass end-pieces. These holes may be drilled after the armature has been annealed, for the iron must be well annealed by heating it to a red heat, and allowing to cool down over night in hot ashes. When the armature has been thus prepared, it should receive a good coat of shellac varnish, and be set to dry.

The brass end-pieces of the armature are cast and then turned up to the required shape; but they may be made in two pieces—disc of sheet brass and boss of brass rod—and brazed together, then turned up to shape. Fig. 4

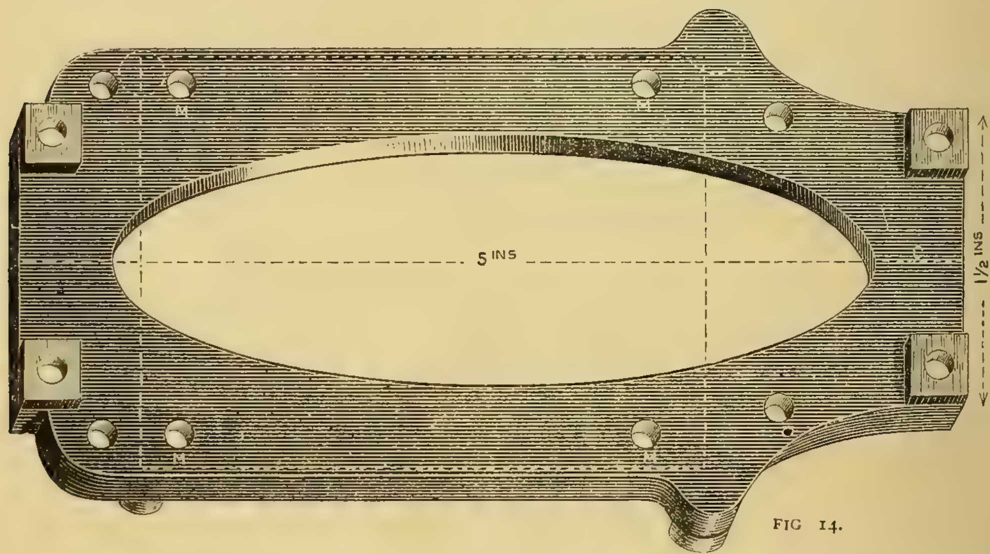


FIG 14.

FIG. 1.—FIELD MAGNET CASTINGS OF MOTOR. FIG. 2.—ARMATURE CASTING OF MOTOR. FIG. 3.—LUG OF POLE-PIECE, BUSHED WITH EBONITE. FIG. 4.—BRASS END-PIECE OF ARMATURE, INSIDE. FIG. 5.—DITTO, OUTSIDE. FIG. 6.—DITTO, SECTION. FIG. 7.—IVORY BUSH FOR END-PIECE OF ARMATURE. FIG. 8.—COMMUTATOR, END ELEVATION. FIG. 9.—COMMUTATOR BRUSH. FIG. 10.—BRUSH HOLDER. FIG. 11.—DIAGRAM OF COMMUTATOR, SHOWING POSITION OF BRUSH. FIG. 12.—BRASS BEARING FOR SPINDLE. FIG. 13.—DIAGRAM OF END OF ARMATURE, SHOWING HOW TO WIND THE COIL. FIG. 14.—BRASS FRAME OR BED-PLATE OF MOTOR. FIG. 15.—DALE'S ELECTRO-MOTOR, END ELEVATION, SHOWING DETACHED ARMATURE IN FRONT OF MOTOR.

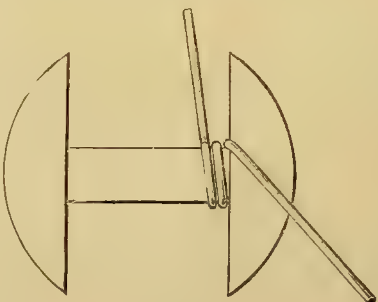
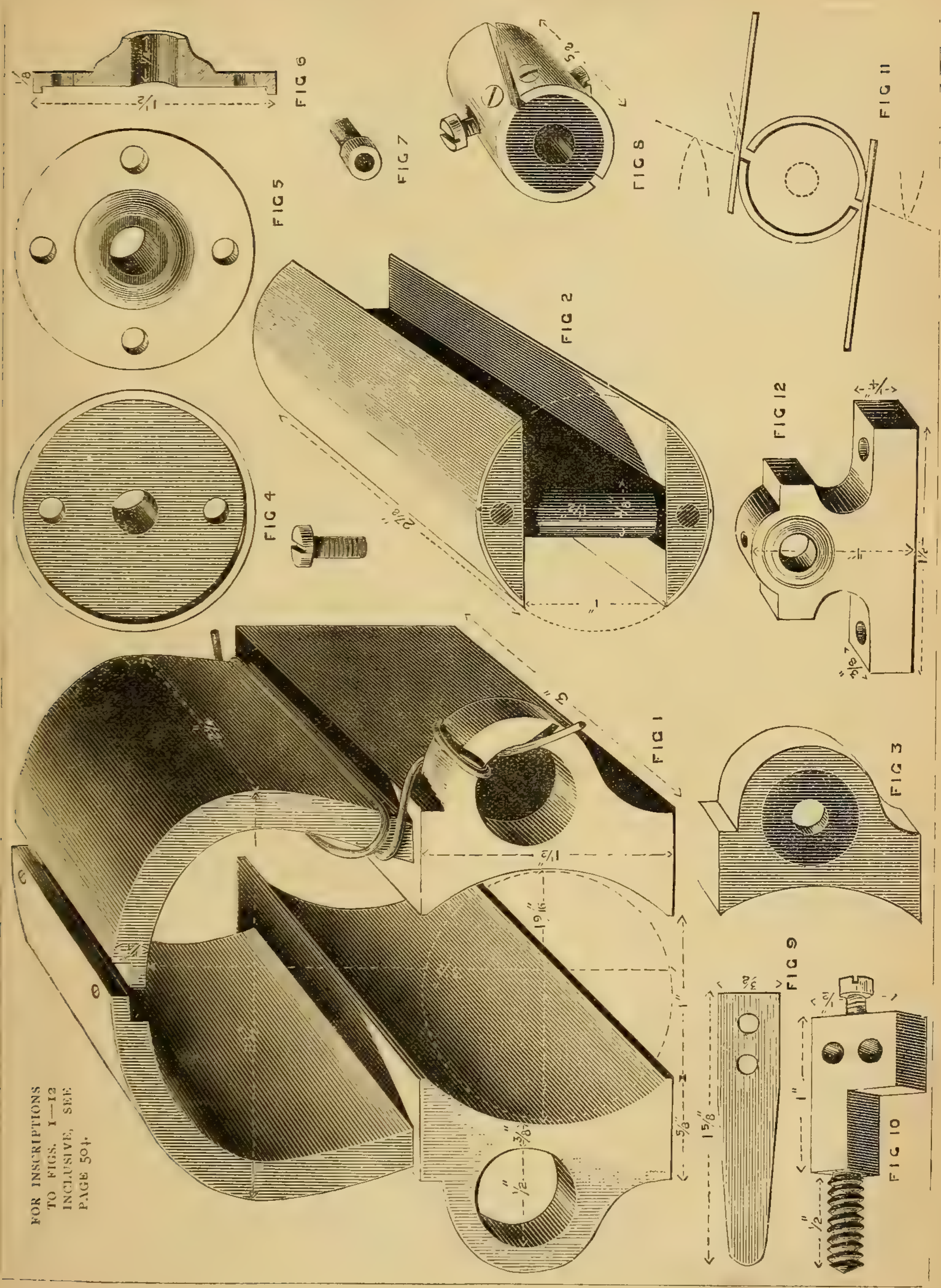


FIG. 13.



FOR INSCRIPTIONS TO FIGS. 1—12 INCLUSIVE, SEE PAGE 504.

shows the inside face of one end; Fig. 5 shows the outside face of the other end; and Fig. 6 is a sectional drawing of the end, full size. The sketch, Fig. 4, shows the inside of the end-piece for that end of the armature next the driving pulley of the machine. The dimensions of this are to be exactly the same as that of the end-piece next the commutator end of the armature; but the latter must be made to vary from the former, in having 4 holes drilled in it instead of two. The two extra holes are for the ends of the armature coil to pass through, and these must be bushed with a bit of ivory or bone in each, shaped as shown Fig. 7. The dimensions of the end-pieces are: extreme diameter, $1\frac{1}{2}$ inches; thickness of rims, $\frac{1}{8}$ inch; depth of boss, $\frac{1}{4}$ inch, tapering from $\frac{5}{8}$ to $\frac{1}{4}$ inch. The projecting rims on the inside faces are formed by turning down the inside faces to $\frac{1}{16}$ inch in thickness. The bosses are drilled to receive two steel spindles, 2 by $\frac{7}{16}$ inches, firmly fitted into the end-pieces. Having got these parts ready, it will be well to fit them together, place the armature with its spindles in a lathe, and true them all up together.

The Commutator.—An electro-motor works by a series of jerks given to the armature by the F. Ms., and these jerks are regulated by the part named the commutator. The current traversing the F. M. coil excites the poles of the F. Ms. and causes them to attract the faces of the armature. If there were no commutators the faces would be merely jerked into a position in a line with the strongest attraction and there be fixed, whilst the armature would not revolve at all. By the use of a commutator the circuit is broken just a fraction of a moment under the exact time when the force of attraction is highest on the armature; and, as a consequence, the impetus of the first pull carries the centres of the faces of the armature past the point of the highest attraction and brings the edges near that point just when contact is made again by the commutator. The commutator is therefore fixed on one spindle of the armature, to be carried around with it, and automatically govern its motions. Fig. 8 shows the form of commutator used with this machine; it is called a two-part commutator because made in two parts, that is, the ring is equally divided into two parts. It is composed of the ring in two segments, and the core. The core should be of ebonite, because the ring must be insulated from the spindle of the machine. Fit on the spindle a boss of ebonite $\frac{3}{8}$ inch in diameter, and the same in depth, and turn it up true; on this fit securely and exactly a ferrule of brass $\frac{1}{32}$ inch in thickness, and see that it does not touch the boss of the brass end-piece; next divide the ferrule by a mark, made in line with each right hand edge of the armature faces, into two equal segments, and fasten these to the ebonite boss or nave with four small brass screws. The heads of these screws must be countersunk into the brass, for they will have to be turned down smooth after the ferrule is fixed. Next drill two holes for brass set screws in the centre of each of the two segments and near the inside edges. These screws will pass into the ebonite boss as the first did, but the tips must not touch the spindle; in these screws the free ends of the armature coil will be fastened. The position of all these screws is shown in Fig. 8. The brass ferrule must now be actually divided into two equal parts by an oblique saw cut $\frac{1}{32}$ inch in width, cleanly cut down to the ebonite, not a particle of metal, even a filing, may bridge the cut. The obliquity of the cut is plainly shown in the sketch. It runs $\frac{1}{8}$ inch to the right out of the line first marked on the ferrule. When this has been done secure the segments in their places, mount the armature again in the lathe, and this time true the commutator, leaving it perfectly round and smooth.

The Brushes.—These are strips of hard brass which bridge the commutator segments and form a connection between them and the F. M. coil in the circuit. In this machine they are made of 26 gauge hard spring brass of the size and shape shown at Fig. 9. The two $\frac{1}{8}$ inch holes at one end are for two small set screws to secure them to the brush-holders, one of which is shown full size at Fig. 10. These holders are made of brass. One end of each, $\frac{1}{2}$ by $\frac{1}{4}$ inch, is rounded and screwed to fit a hole drilled in the ebonite boss shown in the lug at Fig. 3. This insulates the brush-holders from the F. Ms. by a similar means to that adopted in insulating the commutator from the armature. The position given to these brushes relative to the commutator, and to the armature faces, is shown at Fig. 11.

The Frame and Bearings.—The frame is a plate of cast brass of the size and shape shown at Fig. 14. It will be seen that there are two raised pieces at each end, and in each of these an $\frac{1}{8}$ inch hole is drilled. Those raised pieces receive the feet of the bearings, and these are fastened to the frame by $\frac{1}{8}$ inch iron or steel set screws. The four holes, M, M, M, M, must be countersunk to the underside of the frame to receive the heads of four $\frac{1}{8}$ inch set screws passing into the F. Ms. The other four holes are for screws to fasten the machine to a wooden frame or stand. The bearings are of gun-metal, of the size and shape shown at Fig. 12—viz., as to size, length of plummer block, $1\frac{1}{2}$ inch; width, $\frac{3}{8}$ inch; thickness, $\frac{1}{4}$ inch; from foot of plummer block to centre of bearing, $\frac{3}{4}$ inch; height of plummer block and bearing, 1 inch.

The Field Magnet Coil.—The field magnet, that is, the arched part of the motor, must now be wound

with four layers of No. 18 cotton-covered and paraffined copper wire. First envelope the arch in a layer of tough cartridge paper coated with shellac varnish, and allow this to set before the wire is wound upon it. If the wire is not covered with paraffin, make it into a hank or coil, and soak it in melted paraffin (paraffin wax, as it is sometimes called), and allow this to set; then wind it back on the bobbin and proceed to wind it on the arch. Fasten 6 inches of the free end into the right-hand lug of the pole-piece, pass the wire inside the arch, then around its foot and inside again, as shown at Fig. 1, and thus proceed laying the coils of wire side by side, as close as they can be got, until the whole arch has been covered with them; then wind back again carefully with another layer of coils, then forward with another, and finally back to the point of starting, where a free end of 6 inches must be left and secured temporarily by twisting it around the first end. The whole wire should now be coated with red shellac varnish or sealing wax varnish, and the outside and ends of pole-pieces with black varnish.

The Armature Coil.—The armature, Fig. 2, must next be wound with four layers of No. 20 cotton-covered and paraffined copper wire nicely laid side by side, or as much of this as can be got into the armature groove without bulging out at the ends or sides. First envelope the web of the armature with varnished paper, as directed for the cores of the magnets. Hold the armature by one of the cheeks, in the left hand, and the bobbin of wire in the right hand, and commence winding the wire around the web next the right-hand cheek of the armature, over from left to right, as shown at Fig. 13, laying each coil neatly and securely side by side, forward and backward, until the space has been filled. If found more convenient, one of the cheeks may be held in a vice whilst the coil is wound on. When wound, twist the two ends together just to hold them whilst the coils are varnished, as were the coils of the magnet.

Care must be taken whilst winding the wire not to strip the covering, and if this is done by accident, immediately repair the damage by covering the bare spot with soft cotton soaked in paraffin. The wire must not be kinked or snarled, and should be evenly run on. The coils of wire on the armature must not bulge out beyond the circle of its diameter, or they will strike the poles of the F. Ms. whilst revolving. They may be reduced to their proper position by a few blows from a stick of soft wood. The wires of both coils must be in one continuous length from end to end of each coil. After they have been wound, the insulation of the coils should be tested by sending a current through them from a Bunsen or bichromate cell, with a galvanometer or current detector included in the circuit. The needle of the detector should show a strong current passing when the coils are connected in circuit, but none at all when only one end of the coil is connected, and an attempt is made to get the current to pass through the iron of armature or F. Ms. If the needle shows current passing when any part of the iron is touched with the wire from the battery, it will prove that the bare copper of the coil touches the iron in some part, and this must not be allowed.

Putting the Parts Together.—Untwist the ends of the armature coil, bring the wires through the two ivory bushes in commutator end-piece, and secure them to the armature. Clean the bared ends of these wires and secure them by their set screws, one to each segment of the commutator. Fix the F. Ms. to the base plate of the machine, with the lugs next the end marked C on Fig. 14. Next fit the ebonite bushes in the lugs, as shown at Fig. 3, insert the brush-holders, Fig. 10, and secure the brushes, Fig. 9, to them. Connect the outside end of the F. M. coil to the right-hand brush-holder by the set screw provided in the end for that purpose; leave the other end free at present: by it the current enters from the battery, passing by a wire attached to the other brush-holder. Next screw on the front bearing, place the armature in position in between the pole-pieces of the F. M. from the back, with the brushes gripping the commutator on each side; then put on the back bearing. The spindle at the back end of the armature will bear a driving pulley, either a three-speed grooved pulley like that shown in the engraving or a simple brass pulley with one speed. Give the base-plate and the pole-pieces of the F. M. a coat of black japan; leave the brass bearings, and other brass fittings, bright. If the motor is to be used on the bench of a small machine, with a small switch to turn the current on and off, screw the bed-plate down to the bench, connect the free end of the F. M. coil to the switch, and connect the free battery wire to the set screw on left-hand brush-holder. The engraving, Fig. 15, shows the motor mounted on a stand of polished mahogany, fitted with two binding screws. A wire goes from the left-hand screw down through the stand, under it, in a groove, then up under left-hand brush-holder, to which it is fastened as shown. The free end of F. M. coil goes down through the stand, then up under the left-hand binding screw.

Battery Power and Strength.—The battery power needed to fully develope the power of this little motor, is that furnished by six Bunsen cells of quart size in series, and then it will work a small dental machine, or spin around a small rotary stand with figures on it, or a set of vacuum tubes to form an advertisement in a shop window. An ingenious suggestion to use small

electric lamps with tinted globes, on a rotary stand worked by a small motor, was given in the *Electrician* not long since; such a small motor as this would do well for the purpose. Its price, complete, is 45s., or a set of castings for it may be had for 8s. from Messrs. H. & E. J. Dale, 26, *Ludgate Hill, London, E.C.*

Small motors must have current supplied them from such strong constant batteries as the Bunsen, Grove, or double fluid chromate batteries. Even then the best of them only develope in mechanical power from 40 to 50 per cent. of the electrical energy generated in the battery. Larger motors, from one-horse power upward, are more economical; but these require to be worked by current from a dynamo electric machine direct, or from accumulators stored with electricity. The further development of the subject in this direction may be considered by me in a future paper.

WOOD-CARVING IN IRISH BOG OAK.

By ALEXANDER WATT.

IV.—Carving Shamrock Studs—Veining the Shamrock Leaf—Bog Oak Fly-Stud—Carving in Relief—How to make an Ornamental Box.

CARVING SHAMROCK STUDS.—To produce these pretty ornaments for the shirt front, or cuff, we must first avail ourselves of the services of a hard-wood turner, who, for a very trifling sum, would quickly turn, from a sound piece of bog oak, as many "blanks" as may be required for one or two sets of studs. The sectional sketch in Fig. 14 will sufficiently indicate the form and size of the blank, but the latter point, however, may be left to the taste of the carver; if for a cuff stud, or "solitaire," the blank should be somewhat larger than that shown in section. Having obtained the requisite blanks, we proceed as directed below; but before entering into details, however, will advise the amateur carver to provide himself with a convenient addition to his work-table or bench, called the "pin" by jewellers. This consists of a piece of hard wood (beech, for example) about $\frac{3}{4}$ inch thick, 5 inches long, and 3 inches wide. This block, or "pin," must be screwed to the table, leaving only 3 inches of its length projecting. Before fixing in its place, the upper face of the projecting portion should be bevelled to the extent of half its thickness, so that, when in its place, the pin will have a slight incline, which makes it much more convenient to work upon. The tools required at hand for carving the shamrock studs will be the two veining tools (Figs. 2 and 3), the small chisel, graver, and a small fine-cut half-round file. In the first instance, two cross lines must be drawn on the face of the blank, so as to leave four equidistant spaces, or segments, as in Fig. 15. These should next be lightly cut through with the graver; we then take a half-round file, and clear away the wood a little from the end of each line, at the outer edge, as indicated by the blank spaces, Fig. 16, so as to form the separate leaflets which constitute the shamrock leaf—bearing in mind that the fourth segment is destined for the stalk, as shown. In forming the leaflets with the file, great care must be taken to preserve the proper outline, and the filing operation must be continued down the edge of the blank to the back, by forming a groove in each case to correspond with the space between each segment. When this is done, the stalk may be traced in pencil, then engraved, as before, and we may next proceed to clear away the surplus wood represented by the blank spaces on either side of the stalk. This may be readily done with the small chisel (removing only small portions of wood at a time) and finishing with the small half-round file. We must now turn our attention to the several divisions of the shamrock leaf, and our operations in this direction will require all the skill we possess, since false cuts, or breaking away portions of edges of the leaflets, will hopelessly spoil the design: with a steady hand, and taking care to hold the model firmly, no such mishaps need occur. Now taking the small chisel in hand, and bringing the thumb within $\frac{1}{4}$ inch from the point of its blade, we must begin by cutting downward in a slanting direction from the outer edge, along the line in the centre of the leaflet, to its point of junction with the others—that is, to the middle of the object. After having cut down to a slight extent on this side of the dividing line of this segment, the chisel must be reversed, and the division on the right cut down to the same depth, and at the same angle, as in the former case. Alternate cuttings of the left and right halves of the leaflet must be continued until a hollow or groove is formed of about this angle $\vee$, and it is essential that both halves exactly correspond and meet together in a direct line with the centre of the opposite leaflet. The second and third leaflets are next to be treated in the same way, and the piece of work should then be examined to ascertain if all the grooves are of equal depth, and all meeting in a common centre.

Veining the Shamrock Leaf.—The veining tools must be well sharpened by rubbing their faces upon an oil-stone, holding them at such an angle (about 45 degrees) that the grooved cutting edge of each tool just comes in contact with the stone. This

must be done with care, and the student should practise a little upon a waste piece of wood to get into the knack of using the tool steadily, and making perfectly uniform cuts with it. The veined shamrock leaf is shown in Fig. 17. Since the veins will be more clear and distinct if produced by a single cut than if several attempts have to be made, the operator should acquire a bold, decided movement, by which he may be enabled, without faltering, to place the tool in its proper position (that is, at the top edge of the leaf), give the necessary pressure, and leave a perfectly sharp impression of the tool.

When about to vein the shamrock leaf, it must be remembered that each veining tool has a different angle to the other, one being for the right half and the other for the left half of the leaf. It will be well, therefore, to take one of these tools in hand (say the left-hand tool), and with it cut the veins in each of the three divisions for which it is to be used, and next to proceed with the other tool in the same way. When all the veining is done the work must be examined, and if any defects appear, from having held the tool wrongly or otherwise, the defective portion must be again gone over with the tool. In placing the veining tool in position, it must be so held that when it reaches its destination at the bottom of the groove the longer end of its cutting face must just touch the exact centre of the disc. The veining being complete, we must now pass a graver—a lozenge graver by preference—along the centre of each leaflet, making a straight, clean cut, and taking great care that all these three cuts meet in the centre. The stalk may now be formed, and this part must be cut down to a level with the opposite leaflet, in doing which it is better to cut a little from the left and right side alternately, preserving the curved form as shown in the designs, and the upper surface of the stalk should be reduced by scooping out the wood, with the chisel reversed at the inner part of each bend of the stalk. The shamrock stud being now complete, is ready for the final operation of staining and polishing described in the last paper.

FIG 14

FIG 16

FIG 17

FIG 18

FIG 15

FIG 19

FIGS. 14-19.—SHAMROCK AND FLY STUDS.

Bog Oak Fly-stud.—There was a good deal of amusement created in the (then) merry City of Dublin when the fly-stud was first introduced—now nearly fifty years since; and the writer well remembers an incident which happened to himself on the first occasion of his appearing in public with a bog oak fly-stud in his shirt front. Meeting a friend in Sackville Street no sooner had the usual greeting terminated than his friend's eye caught sight of the bluebottle's effigy. "Whisht!" cried he, stealthily "going for" the supposed insect, with the intention of removing it with his two fingers and thumb, "Don't spake a worrd," said he, making a grab at the fly. His chagrin may be imagined when he discovered that the fly stuck to his post like a limpet!

In making the fly-stud, the same blanks are employed as in the former case, the design traced in pencil, and afterwards engraved as in Fig. 18. All the wood surrounding the outline must next be cleared away with the chisel, and the rough surface thus left is then to be rendered smooth with a half-round file. The lower part of the body is next to be cut down a little below the wings and slightly rounded off. The divisions between the head and corselet may be produced with the graver, and these parts (the head and corselet) must be slightly rounded off with a fine-cut file.

The wings (see Fig. 19) may be veined by making several longitudinal cuts with the graver, as indicated in the engraving. Two short cuts with the same tool will form the eyes, and, finally, the lower portion of the body should be scratched, horizontally, with the pointed end of one of the shamrock veining tools, and two horizontal cuts given with the graver, when the thing is complete, with the exception of the legs, which are formed in this way: three small holes are first to be drilled on each side of the fly, in the positions indicated; the legs are next formed out of six short pieces of thin iron wire of equal length. One end of each wire being held by the pliers, is then heated in a candle flame, and brought in contact with a piece of shellac, and while still hot, is to be inserted into one of the drilled holes and worked well about so as to coat the cavity with shellac, and thus secure the wire firmly in its place. When all the wires have thus been fixed in their respective holes, we must take a small pair of pliers and bend each of the wires to represent the several joints of a fly's leg, at the same time taking care to put them as nearly as possible in such a position as a well-conducted housefly would be most likely to assume when standing for a portrait.

Carving in Relief.—Some very fine specimens of bog-oak carving have been produced in Ireland, in the shape of caskets, snuff-boxes and cigar-cases, in which the native shamrock has ever figured as the most prominent feature—relieved, wherever possible, by the equally eminent and adored Irish harp. As a simple illustration of the method adopted for making small ornamental boxes, the following directions for

producing a box for holding small articles of jewellery, such as brooches, rings, etc., may prove useful, and possibly, after one or two successful efforts, induce the amateur carver to try his hand at a more elaborate piece of work.

To begin with, we must select a piece of good bog oak, perfectly free from flaws, from which we must cut longitudinally—or what is termed "plank" way—a slice of wood about $1\frac{1}{2}$ inch thick, $3\frac{1}{2}$ inches long and $2\frac{1}{2}$ inches wide. A second slice should then be cut of the same dimensions, but only about half-an-inch in thickness, to form the lid. Having done this, the two pieces of wood must be held firmly together, and their sides and ends well rubbed upon coarse glass-paper, until the saw marks are obliterated. The upper and lower surfaces of each piece should then be treated in the same way. As it is not proposed to apply hinges to this box, but simply to allow the lid to fit into a projecting collar, to be formed in the upper edge of the box, it will be necessary, when forming the lid, to cut out of its lower surface a hollow sufficiently deep to correspond with the collar referred to, and thus allow the box to close with perfect ease, without being too loose. This arrangement will be more apparent as we progress with the details connected with the internal structure of the box and its lid. Before commencing to form the respective cavities in the box and lid, the two surfaces, as yet rough from saw marks, must be rubbed smooth as before, but should receive a final rubbing upon fine glass-paper. It will be necessary at this point to see that these two surfaces, when brought together, lie perfectly close, all round, as if they were one piece of wood; if such be not the case, a little further rubbing on fine paper must be given until the two surfaces fit close.

To form the projecting collar, which is to fit into the lid of the box, and to hollow out the box itself, we proceed as follows: A pencil line must first be traced on the flat surface about $\frac{1}{8}$ inch from the edge all round. Another line must be traced inside the former, and $\frac{3}{16}$ inch from it, for the collar. Placing the wood upon a firm bench, we must next commence to cut out the cavity forming the interior of the box, for which purpose a sharp $\frac{1}{2}$-inch chisel may be used, with the aid of a small mallet or a hammer. To prevent the wood from shifting, a couple of nails should be driven into the bench about $1\frac{1}{2}$ inch apart, against which the wood must be placed while the hammer and chisel are being used. In clearing out the wood in this way a $\frac{1}{2}$-inch gouge may also be used; but it is not advisable to do the work hurriedly by attempting to cut away large pieces of wood at a time; indeed, the greatest care and patience must be exerted, otherwise some part of the work may suffer: possibly the wood may crack, or the chisel slip and cut into the upper edge, and thus spoil the work. We recommend no such haste, but rather that the task should be performed gradually and cautiously, whereby disappointment may be avoided.

When forming the inside of the box, it is well not to cut too close to the inner pencil line at first, but to leave the final levelling of the sides and ends of the interior until the required depth has been attained. It will also be necessary to avoid cutting too deep, and when the cavity is nearly deep enough, the chisel should be used with the hand alone, that is, to dispense with the hammer. It is proposed that the box when finished should be lined with velvet, therefore the interior will require no further treatment than making it tolerably level at all points, since the lining will cover all defects.

We must now return to the projecting collar, which may be most conveniently formed with the aid of a small and fine-toothed tenon saw. In either case a pencil mark must be drawn $\frac{1}{8}$ inch from the upper edge, on the outer sides and ends of the box, which will correspond with the proposed depth of the collar. If the tenon saw be now used, care must be taken to keep well within the lines, leaving the clearing away of the remainder of the wood to chisel and flat file. The upper edge may first be taken in hand, and the saw, being held in a perfectly horizontal position, must be allowed to depend upon its own weight to form each individual cut; if much force be used, the saw will surely cut into or beyond the pencil lines, and thus spoil the operation. Having made each of the four cuts on the upper edge, the sides and ends must be treated in the same cautious way; and when the saw has done its work, the remainder of the wood up to, but not beyond, the lines may be removed with the chisel, and then finished off with a flat file covered with fine glass-paper. This being done, the collar which is to fit into the lid should be found to project $\frac{1}{8}$ inch from the upper edge of the box, and it may be very slightly rounded at its outer edge by means of fine glass-paper laid over a flat file.

In forming the necessary hollow in the lid, a pencil line $\frac{1}{8}$ inch from the sides and ends must be drawn, to correspond exactly with the position of the projecting rim of the box; when this is done, the piece of wood must be laid flat on the bench, resting against the two nails as before, and a cavity formed with the $\frac{1}{2}$ inch chisel, to the depth of about $\frac{1}{4}$ inch, which will allow for the thickness of the velvet lining. When the bulk of the wood has been cleared away, the greatest nicety must be observed in *fitting the lid to the box.* This must be done by clearing away the wood in the direction of the pencil marks, with the

chisel, gradually and cautiously, so that the respective parts of the box may come together with perfect nicety at all points; at the same time it is essential to avoid cutting away too much wood from the lid, otherwise it will fit loosely and badly. When the lid is so far fitted, the two surfaces of lid and box which have to touch each other must be examined to ascertain if they fit *flush;* if not, any inequalities that prevent this must be removed, for which purpose fine glass-paper spread over a square file may be used, but with great care. When the box and lid are thus properly fitted, the point of junction between them should be barely visible. The outer edge of the closed box should now be again rubbed on fine glass-paper, but to prevent the corners from becoming rounded during the operation, which produces a very ugly appearance in a square box, the two parts, being held firmly together, must be rubbed to and fro on the sheet of glass-paper, moving the arm steadily from the shoulder, and giving long and even strokes: in this way the corners will be preserved, and should appear perfectly sharp when the work is finished.

The construction of the box being now complete, we will next turn attention to the ornamental part of the task, and although this may, to a great extent, be left to the taste and skill of the carver himself, a few suggestions will probably aid the student who may not have had opportunities of noticing the style of ornamentation usually adopted for this class of work. We will, therefore, in our next paper, present one or two illustrations that will serve as a guide, selecting such as are simple in themselves, and therefore more suitable to those who may have had but little practice in this direction.

(*To be continued.*)

AN EBONIZED AND INLAID CABINET FOR BRIC-A-BRAC.

By L. S. D.

I SEND my brother amateurs herewith a sketch of a small ornamental ebonized and inlaid cabinet. The construction is so simple, and the work, if carefully and neatly done, forms so pretty and handsome a piece of furniture for the drawing-room, that those readers who work for profit as well as pleasure will find themselves amply repaid for their trouble, if I may judge from the price I have been offered for mine. The accompanying sketches are for a cabinet 3 feet 6 inches by 3 feet 6 inches, and Figs. 1 and 2 are drawn on an isometrical scale of 1 inch to the foot. The cabinet is shown complete in Fig. 1.

In order to assist amateur woodworkers who think it worth their while to try their hand at it, I give for their guidance the following instructions, which will, with the drawings, I trust, prove sufficiently explicit. The frame, Fig. 2, must first be constructed: this should be made of mahogany $1\frac{1}{2}$ inches square; for a larger cabinet, $1\frac{3}{4}$ inches to 2 inches square. I have selected mahogany, as I have found it takes the ebonizing well; but black walnut, or, in fact, any other hard wood will do equally well. After cutting the pieces the right length, squaring and smoothing them, mark out and cut the mortises at the joints marked *a* in the uprights, and fit the cross-pieces A and B tightly into them. The upper and lower cross-bars A, A, are halved and notched into the centre uprights, as shown in Fig. 4; the piece C is halved and dovetailed into the uprights at the back, as shown in Fig. 5. To brace the parts well together, slots must also be cut in the uprights $\frac{3}{4}$ inch long and $\frac{1}{4}$ inch wide, as shown at C, for the bars of the rails, Fig. 3.

After the whole has been carefully fitted it may be ebonized. This I did according to the receipt I gave, page 389, Vol. III., of AMATEUR WORK; but the last polishing had better be deferred till all is ready to put together. The ebonizing, according to the recipe I gave, is the most troublesome part of the job; possibly some easier method may have been found for arriving at the same results.

The shelves may now be proceeded with; and in order to fit them neatly, the frame should be temporarily put together, and held by screws put through the mortises at the back. The shelves, which should be of wood $\frac{1}{2}$ inch or $\frac{3}{4}$ inch thick, may be either ebonized to match the frame, veneered with walnut, or made of any handsome dark wood, a handsome walnut or rosewood veneer looks well. I made mine of green ebony; but this is probably very expensive at home, though cheap enough out here in Jamaica.

If veneering is considered too troublesome, a well selected piece of black walnut would answer; though it is needless to say that the shelves, especially the top one, are the most attractive part of the cabinet, if made of handsome wood. The edges should in any case be veneered with some of the inlaid borderings of Austrian veneers, sold by Mr. Wilmersdorff, of 72, *Finsbury Pavement*. They can be procured of a variety of patterns, and almost any width; and it would be well to procure these first, selecting the pattern to your taste, and reduce the thickness of the shelves to suit it. They are very inexpensive, and are easily applied with a little glue, and give a very finished appearance to the cabinet. The shelves must, of course, be perfectly smooth and well polished; but this had better be left till all the parts are complete and ready to put together.

The rails, Fig. 3, are made as follows: Cut out eight strips of wood (same as the frame) about $\frac{3}{4}$ inch wide and $\frac{1}{2}$ inch thick, and after cutting them the right length to fit in between the uprights, as seen in Fig. 1, with half an inch to spare at each end, cut them, as shown in Fig. 3, to fit into the slots already cut in the uprights.

Mark and bore the holes for the pins, as shown in Fig. 6, and afterwards smooth and ebonize them. The pins, as well as the knobs and feet (shown also in Fig. 6) must subsequently be turned in box-wood, and polished in the lathe; and after the rail is put in place, a narrow strip of holly $\frac{3}{16}$ inch to $\frac{1}{4}$ inch wide, and about $\frac{1}{8}$ inch thick, smoothed but not polished, may be tacked on with silvered or brass pins along the centre of the top bar by way of finish.

The frame being still temporarily held together, the back panelling may be fitted. The panels should be made of wood $\frac{1}{4}$ inch to $\frac{3}{8}$ inch thick; the pieces for the wings may be cut in one length, to fit tightly in the spaces formed between the uprights and the inside surfaces of the cross-bars, A. The centre panel, if the wood is not wide enough to make it in one piece, may be joined, the join or joinings being concealed by the shelves when in position. The panels are subsequently fixed and held in place by small pieces of wood tacked on behind into the uprights and cross-pieces. The panels must be ebonized to match the frame.

The side-pieces to form the cupboard may at the same time be fitted, but this is more easily and correctly done after the shelves are in place.

The doors of the cupboard ($\frac{1}{2}$ inch thick), unless the wood is very well seasoned, should be framed and panelled, and may be ebonized and painted, as shown in Fig. 1; or what has a better effect, veneer the panel with inlaid pieces of veneer, sold for the purpose by Mr. Wilmersdorff. The panels vary, I think, in price from 2s. to 5s. each; a panel suitable for our present purpose costs, I think, about 1s. 9d. or 2s. If the doors are made solid and not framed, an edging of vulcanite or ebony, according to the width required (if the latter, about $\frac{1}{16}$ inch thick) should be glued round the panel as a sort of false frame.

I veneered the inside of the doors, and cupboard of the cabinet I made with satin-wood $\frac{1}{32}$ inch thick. It gives a little extra trouble, but adds to the appearance.

All the parts above mentioned being fitted, the frame must now be taken to pieces and all the parts nicely polished; and when dry the cabinet may be put together. To do this: First, fit up and glue [the frame together, all but the front uprights or legs, which must be left to the last. The feet and knobs must likewise be glued on, holes having been previously bored in the top of each upright, and in the bottom of the side and front legs to receive them. The hold of the mortises may be further strengthened by screws at the back. The back rails must be fitted in place before the end legs are glued; next glue on the cross-pieces, marked B, which support the shelves, and place the shelves in position and the rails on the top shelf. Last of all, put on the front legs or uprights, gluing the mortises and bracing all together by means of 2 inch screws countersunk 1 inch through the cross-pieces, A, A, into the back of the shelves, and through the front legs into the front edges of the shelves; these latter holes must be afterwards plugged with small boxwood buttons, projecting slightly from the surface, as shown in the sketch.

The panels at the back may now be fitted in place, and the side-pieces which form the cupboard. In order to fix these, a small strip of wood, the same width as the centre cross-bars, B, should be attached to the upper surface of the third shelf, in a line, and corresponding with the support below; and the side panels should be of such a thickness that when glued or tacked on to the support above, and to the strip of wood below, the outer surface comes flush with the edges of the uprights. Two panels, one on each side, must be fixed in a similar manner inside the cupboard, to form a double casing.

If the inside of the cupboard is to be veneered with satinwood, the veneer must be put on the inside pieces before they are fixed in place; the same would apply to the panel at the back.

A frame must now be made for the bevelled mirror to fit tightly into the space left at the top, and the mirror let in, like a picture in a frame. This frame should be veneered like the shelves, with a wide bordering of inlaid veneer about 2 inches wide; the width, however, will depend on the size of the mirror. The frame may be brought flush with the edges of the supports and shelves, or, if preferred, it can be let in with a moulding in front; it must be fixed at the back in a similar manner to the panels.

The doors may now be hung. I used some of the ornamental nickel-plated hinges sold for the purpose, with one of the French catches to match.

The cabinet is now complete, with the exception of a little decoration. The top ornament may be a carving, as in the drawing, or a rail similar to those below, or it can be left plain. A narrow strip of holly $\frac{3}{16}$ inch to $\frac{1}{4}$ inch wide, and about $\frac{1}{8}$ inch thick, neatly smoothed, but not polished, which has the appearance of ivory on the ebonized wood, may be fixed on with silvered or brass pins down the centre of the front legs between the buttons, and also round the frame of the mirror, as I have endeavoured to show in the sketch. The ebonizing may be dull polished, if pre-

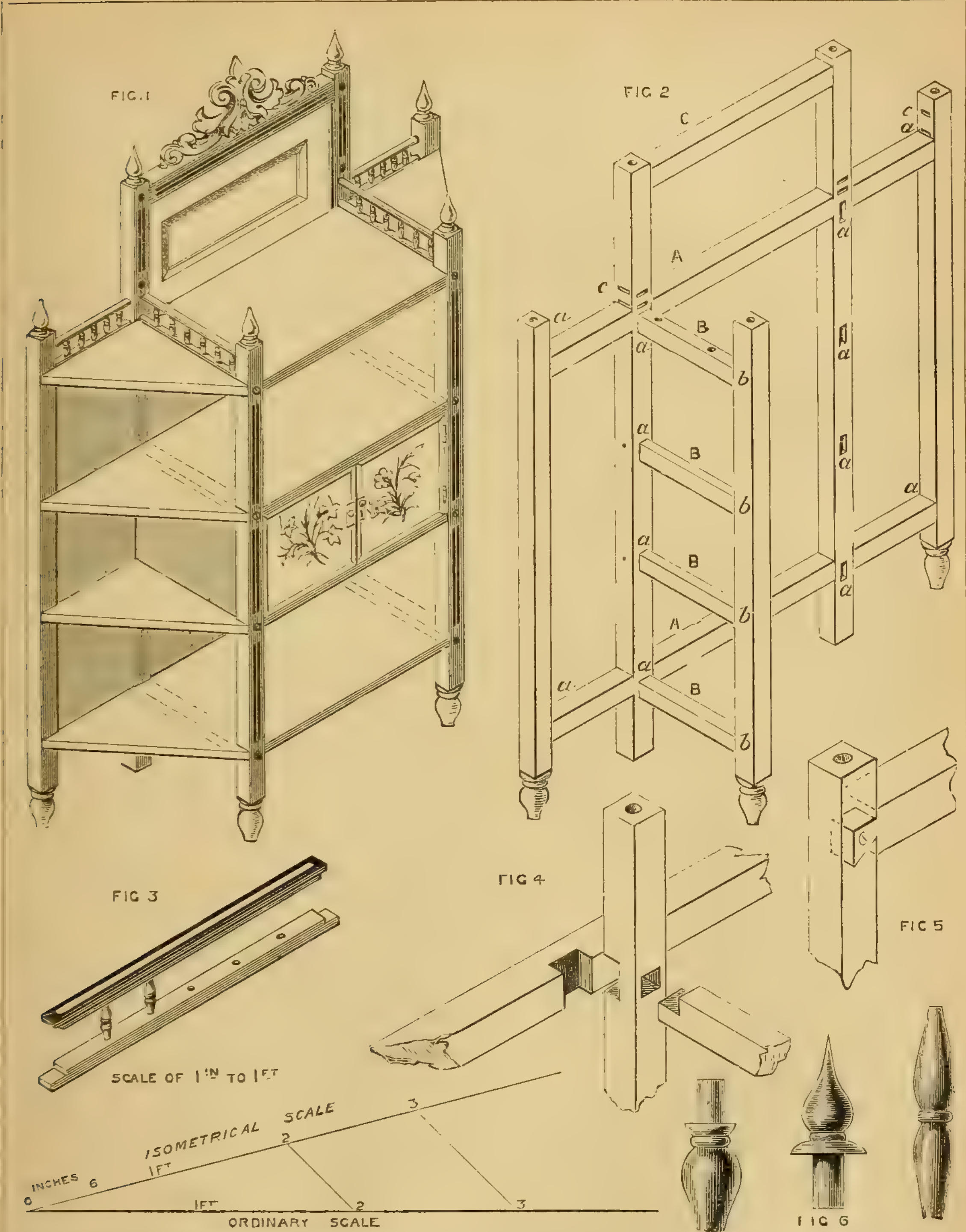


FIG. 1.—SKETCH OF CABINET COMPLETE. FIG. 2.—FRAME OR SKELETON OF CABINET. FIG. 3.—RAILS AND SPINDLES AT TOP OF CABINET. FIG. 4.—HALVED AND NOTCHED JOINT FOR FRAME WORK. FIG. 5.—HALVED AND DOVETAILED JOINT FOR FRAME WORK. FIG. 6.—TURNED TOP, FOOT, AND SPINDLE FOR CABINET.

ferred: and if the shelves are ebonized, possibly the effect would be better; but if the shelves are polished wood, the frame should, I think, be bright polished also.

DRY-PLATE PHOTOGRAPHY.

By C. C. VEVERS.

XIII.—TRIMMING PRINTS—MOUNTING—SPOTTING—BURNISHING—ENCAUSTIC PASTE—ENAMELLING—CONCLUSION.

MANY photographers prefer to trim the prints before toning, while others (myself amongst the rest) think it better to leave this until after the toning, fixing, and washing operations. Much can be said for and against both methods; for instance, the professional by trimming his prints previous to toning secures the silver contained in the waste, and at the same time prevents a considerable loss of gold, which would otherwise be used in toning this waste paper; again, prints having a sharply-cut edge are not so liable to tear by being handled in the various solutions as are those having jagged edges. On the other hand, if the paper is carefully cut with a suitable knife, there will be little or no rough edges to encourage tearing. At the same time, when a print is trimmed ready for mounting, it is often spoilt by the action of a too energetic toning-bath, by turning the edges blue, as described in the last paper, which edges would, if the print were trimmed after toning, be cut away. Again, if the prints are cut while slightly damp, the glass shape will remain firmly in one position on the print, while on a dry print it is apt to slip about, cause the edges to be cut out of square, and probably result in cut fingers into the bargain. But perhaps the greatest disadvantage which arises from cutting the prints before toning is this: owing to long immersion in the washing water, a print is liable to stretch in the direction of the fibre of the paper, as much as $\frac{3}{8}$ in. in the length of a carte-de-visite in some cases; this has the effect of distorting the picture, making a striking change in portraits, and can only be obviated by more rapid washing. I have in many instances found a print properly cut in the first place to be too long or too wide to be mounted on the card without recutting. Now, when the prints are cut after washing no further stretching can take place, and the whole of the prints will be the same size. I have placed the defects and advantages of both methods plainly before the reader, and he is now left to decide by practice which way he himself prefers

For cutting prints a sheet of zinc, glass, or very hard wood, a few inches larger than the print, a piece of thick plate glass, carefully cut and ground at the edges, and measuring about $3\frac{5}{8}$ in. by $2\frac{1}{4}$ in. for carte-de-visite and 6 in. by 4 in. for cabinet prints, and a sharp knife (Fig. 67), similar to a shoemaker's, will be required. A sheet of smooth zinc will, I think, be found best for a "cutting-board"; cutting shapes can be purchased at any dealer's, at about 7d. and 1s. 2d. for carte-de-visite and cabinet size respectively, as can the cutting-knife for about 6d.

The prints should be removed from the blotting-book while still damp enough to prevent their curling; they should be placed on a sheet of blotting-paper, face downwards, one on the top of the other, in as many heaps as there are sizes. The knife should be well sharpened on a hone. A print is placed face upwards on the cutting-board, the glass shape adjusted over it and held with the fingers of the left hand, while the knife is run round the edges of the shape, commencing first at the top, then the right side, next the bottom, and lastly the left side, keeping the left fingers resting on the shape the whole of the time. The point of the knife must be used, and should run along the bottom edge; the stroke should be quick and determined, cutting off each piece the first time. Should the print be too damp or the knife blunt, the edges of the print will be roughly torn, and not cut off; while if the print be quite dry some difficulty will be experienced in keeping the shape steady. When cutting prints with white margins, the sides must be left symmetrical, while for dome and square masks and architectural subjects the sides of the shape must be placed perfectly parallel with the lines of the picture. In cutting masked and vignette prints, a little more margin must be left at the bottom than at the top of the print. As each print is cut it is placed face down on the top of its predecessor, and when all are finished they may be put under slight pressure to prevent them curling, until ready for mounting.

In America "Robinson's Trimmer" is almost universally used as a substitute for the knife for cutting prints. It consists (Fig. 68) of a small wheel of very hard steel, which rotates at the end of a suitable handle, on the same principle as a glass cutter. These trimmers do not cut but *pinch* off the waste paper, and leave the print with a bevelled edge, which facilitates adherence to the mount.

There are, of course, several styles of mounts for photographs: small cards for insertion in albums, large mounts and "cut-out" mounts for framing, scrap-albums, etc. One thing the amateur should never omit to do—he should keep a large "scrap" album, purchasable at most photographic depôts, and into this album he should place a print from every

negative he makes, whether good, bad, or indifferent; if the prints consist chiefly of the two last qualities, the book need by no means be kept for exhibition, but for private reference only. The prints may be pasted on the leaves of this book, or merely secured by inserting the corners through slits cut in the leaves for that purpose. Underneath each print (or on the opposite page if but one side of the leaf is used for attaching the prints to) brief but intelligible particulars as to when, where, and how the negative and print were made, should be written; by this means the amateur will have a valuable supplement to his note-book with which he can compare his work, and learn something every time he opens its pages, for not only is it pleasant to turn back to excursions and pictures that would otherwise have escaped the memory, but much instruction may be derived from the failures by comparing the various data of these with that of the more successful pictures, thereby discovering how the mistake was made, and remedying the errors in future operations.

The following may be taken as an example of how such notes should be entered:—Subject, Adel Church. Date, 13/11/86. Time, 2.35; weak sunlight. Exposure, 18 secs. Plate, Ilford ordinary. Lens, rectilinear. Stop, *f*. Developer, potash. Print, Eastman's "C" Bromide. Results: negative correct; print slightly over-exposed and developed.

Many amateurs seem to consider the only desideratum is the production of a good negative, and having satisfied themselves by admiring and pondering over it, will place it on one side and possibly forget it ever existed, without having made even a rough proof from it. Now, no doubt a clever photographer can see the beauties and faults of a picture quite as well in the negative as in a print; but he should not forget that his friends fail to see anything attractive in a view with black sky and white trees, and, if for their satisfaction only, he should never omit to make a print from each negative he takes.

The commonest style of mounting quarter and half-plate photographs, is on cards adapted for insertion in albums. Mounts of every hue and variety may be obtained. They are manufactured with a "Bristol" (plain), or "enamelled" (highly glazed) surface, with round corners or square corners, white or tinted, with plain, carmine, or gilt edges, also with printed rands (margins), and lines in red, carmine, or gold, and finally with a fancy design printed on the back, in colours or gold. Of course, in the selection of mounts, the amateur must consult his own tastes; but I would warn him against using brightly tinted mounts, especially blue, which will destroy the beauty of almost any photographer. The same may be said of all gaudy borders; also mounts printed in bronze should be avoided, as this, in addition to discolouring very rapidly, has the effect of causing the photograph to fade in an incredibly short time. Perhaps one of the best mounts for general work is one of a cream, pale straw or salmon tint, with round corners, and, if desired, a thin red line printed on the front. Such a mount is procurable at any dealer's at about 1s. 2d. per 100 for cartes-de-visite and 3s. 6d. for cabinet size. Mounts having a deep carmine rand should not be used, as the colour is rubbed over the photograph in burnishing, unless a very light pressure is applied. Undoubtedly the handsomest mount manufactured, and one that has become very popular, is that with gold bevel edges. These mounts are cut in all colours, but those of a rich dark colour, such as black, chocolate, olive green, are the best, as they show the bright bevelled edge to better advantage. The price of these mounts is naturally higher than for plain ones, averaging 3s. 6d. per hundred for cartes-de-visite, and 7s. for cabinets. While on the subject of gold-bevelled mounts, I would draw attention to a speciality of Mr. J. Fallowfield's. This consists of a series of oval and round mounts in all tints, with gold bevels, which are very suitable for bits of scenery, and form pleasing Christmas or birthday cards.

Another neat combination of mount and frame is supplied by Marion and Co., and J. Fallowfield. It is composed of a narrow brass rim of oval, circular, or "cushion" shape, with glass and cardboard back to fit, and a small ring attached for hanging purposes. After inserting the photograph, the rim, which is made of thin stamped metal, is bent over at the back, firmly securing the whole without the use of sprigs or tacks. For vignette views, with broad white margins, these frames are especially adapted.

Prints intended for framing should be mounted on a rough piece of card, and afterwards behind a "cut-out" mount, having a square, oval, or cushion-shaped opening, or on a large mount with red "Oxford line," or "India tint." Messrs. Brown, Scott, and Co., *Red Lion Yard*, 254, *High Holborn*, manufacture every variety of cut-out mounts, and frames, while Mr. J. Fallowfield has a large stock of view mounts of every description.

Now as to the mounting medium, the most essential features of which are that it shall not turn acid or deteriorate in any way, and by so doing cause the prints to fade, that it can be easily applied, and shall produce a minimum of curling or "cockling" when the prints are drying. The most satisfactory medium for prints up to half-plate size is one composed of gelatine, glycerine, and alcohol. The following solution I have used for some years:—

Gelatine (best)	2 oz.	Methylated Spirit	2 oz.
Glycerine	½ ,,	Water	8 ,,

The gelatine is placed in the water and dissolved by immersing the vessel containing it in hot water; the glycerine is then added, and, finally, the spirit is gradually poured in, stirring the solution at the time. When cool the solution will form a stiff jelly, which must be remelted when required for use by placing the bottle containing it in hot water, when it may be applied to the back of the print with a broad camel-hair brush. For prints larger than half-plate size, perhaps a more handy mountant is a paste made of starch or arrowroot, the latter preferable. It is made into a stiff cream by boiling in water; the lumps must be carefully broken, and when ready for use a drop of carbolic acid should be added to each ounce of the paste to prevent decomposition and the consequent ruination of the prints. Paste is best applied with a small piece of sponge. Whatever medium is used, the whole of the back of the print must be painted with it, especial care being taken that none of the corners or edges have been missed, or these, when dry, will curl away from the mount and cause endless trouble.

The print to be mounted is laid face down on a clean piece of paper to the right of the operator, the mount and a sheet of blotting-paper to the left. The medium is applied, the print reversed and laid slowly on the mount, leaving a margin of equal width at the top and two sides, but somewhat broader at the bottom. It is important that the edges of the print coincide with those of the mount; the least carelessness in this respect may easily spoil the effect of an otherwise perfect picture. H. P. Robinson says, "A good photograph badly mounted is like a jewel ill set."

When a large mount is used, the correct distances should be measured, and faint pencil marks made where the corners of the print should be. If the print is to be mounted on large boards or in an album, it should first be burnished, thereby giving it a fair amount of smoothness when finished, and also prevent the leaves of the album cockling to any great extent. The piece of blotting-paper is now laid over the print and mount, which are held together with the fingers of the left hand, while with the side of the right hand, or with a "squeezer," rub the print down from the centre outwards, turning it round from time to time so as to bring each side alternately under pressure of the hand.

Mounted prints require three or four hours to dry in a temperature of from 60° to 70°; they should be allowed to dry gradually, and not hurriedly by placing before a fire. When about half dry, the surface of the print should be cleaned with a piece of damp linen, to remove any of the mounting solution, bits of blotting-paper, or dirt that may adhere to it. White spots and similar defects are then carefully "spotted out" with water-colours and a very fine camel-hair brush. The required tint is produced by a mixture of Indian ink, crimson lake, and Prussian blue, and a small trace of gum to give a slight gloss to the colour. The paint should be applied from an almost dry brush, and worked up to the required depth by repeated applications.

The photograph is now, in a sense, finished, but to be perfect should be burnished. This operation consists of drawing the face of the picture over a hot and highly-polished steel bar, which has the effect of giving it a smooth—almost glossy—well-finished appearance. A machine having a bar 6½ or 7 inches long will be required for prints up to cabinet size. The lowest price for such a machine, until recently, was 30s., at which price the "Optimus" (Fig. 69) is far the best; but this price very few amateurs care to give, and has led the writer to introduce a neat, well-made machine, with 6½ inches bar, to sell at 12s. 6d. It is illustrated in Fig. 70; it has a stand bearing the bar of best silver-steel, and a roller above with handle to turn it. The bar is removable for cleaning and polishing, which should always be done before using the machine, by means of oil and emery powder or bath-brick, which is rubbed lengthways over the bar with a piece of flat wood. A simpler way, and, I believe, equally efficacious, is effected by rubbing the bar on a common knife board. The bar can be adjusted for any thickness of card by means of a screw. A spirit lamp or Bunsen gas burner (costing 1s. and 2s. 6d. respectively) is employed for heating the bar by placing it underneath.

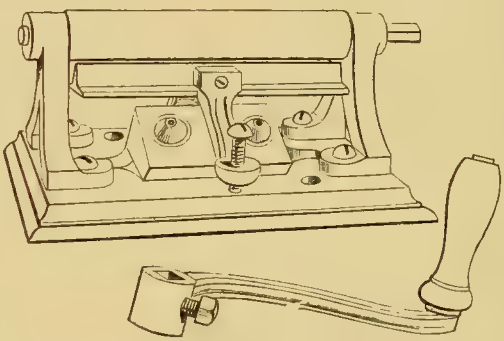


FIG. 70.—VEVERS' BURNISHER.

The photographs should not be too dry; indeed, some operators prefer to have them slightly damp, as a higher gloss is then obtained, but unless sufficiently dry the machine will scrape the print from the mount. The bar must be heated considerably hotter than the hand will bear; if not hot enough it will not give the desired gloss, while if too hot it will produce blisters, and otherwise spoil the print. Each photograph is lightly dusted with a clean cloth before

passing it through the machine; the edge of the card is then placed between the bar and roller and the photograph drawn through, first lengthways, back again, then sideways. It must be passed through with one continuous movement, a stoppage over the bar, however brief, is almost certain to burn a dark line across the print. As the photograph is going through the first time, it should be held at the back and slightly bent towards the roller, this will cause the mount to be perfectly flat when finished. If the print has not, after passing over the bar four times, acquired a sufficient degree of burnish, the bar is not hot enough, or sufficient pressure has not been applied. Unmounted prints may be burnished by placing behind them a waste mount, but unless the print is kept very straight it will be creased when passing through the machine.

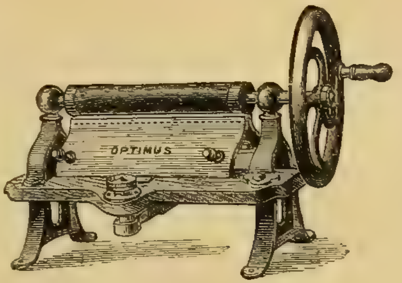


FIG. 69.—OPTIMUS PRESSER.

A "lubricator" is often applied to the surface of the print before burnishing to give a higher gloss; white wax or Castile soap, dissolved in alcohol, are generally used, and are applied to the photographs with a bit of clean flannel, and when dry passed through the burnisher as usual. Adam Salomon's Encaustic Paste has become justly celebrated for giving a rich surface without the necessity of burnishing, but its ingredients are rather complicated. The formula is :—


FIG. 71.—SQUEEGEE.


FIG. 67.—CUTTING KNIFE.

Pure Virgin Wax	50 parts.
Gum Elemi	1 ,,
Benzole	20 ,,
Essence of Lavender . . .	30 ,,
Oil of Spike	1½ ,,

Melt the whole on a water-bath, mix thoroughly, and strain through muslin. A simpler plan will be to dissolve the elemi in the solvents as described above, and, after filtering, mix with the melted wax, as the filtration, which is chiefly intended for the gum elemi, is more easily managed before the wax is present. This, when finished, forms a stiff paste. By increasing the proportion of essence of lavender it can be made thinner, which in winter may be desirable. The encaustic paste is put on the print in patches in three or four parts, and then rubbed with a light quick motion with a piece of flannel, until a firm fine surface is obtained. If a rich, thick coating of the encaustic be desired, a very light pressure in rubbing is necessary, so that a polish may be acquired without rubbing off the paste in the operation. If a print be retouched or spotted, more especial care is required to use a light hand in applying the paste.

A more popular method of attaining a highly glazed surface is known as enamelling; it certainly has the effect of giving great depth and brilliancy to the shadows, but should only be introduced for head-and-bust portraits, while for groups or views it is very inartistic. The materials required for enamelling are: pieces of glass, a little larger than the prints, free from lumps or scratches—patent plate is the best; a small bottle of Thomas's or Mawson and Swan's Enamel Collodion; an ounce or two of Nelson's transparent gelatine; a squeegee —a strap of india-rubber about 1 inch wide let into a piece of wood to form a handle (Fig. 71); and some thin cardboard. The glass is cleaned and carefully polished with chalk or powdered talc, all trace of dirt or grease being perfectly removed; it is then coated with the collodion after the manner of varnishing a negative, and allowed to set, which it will do in a few minutes; it is next washed in clean water until the greasiness has disappeared from the film. The print to be enamelled, unmounted, and with uncut edges, is immersed in a weak solution of gelatine—½ ounce to water 5 ounces—and when perfectly saturated is removed and quickly laid face down on the collodionized plate. The print is now held in its place with one hand while the squeegee is lightly drawn over the back to remove the surplus gelatine, any air bubbles that may have formed between the print and collodion, and to ensure perfect contact. The plate is next put on one side for half an hour until the gelatine has set. A piece of thin cardboard is then attached to the back of the print with a strong mounting medium. The plate is now placed in a temperature of 70° or 80°, and allowed to remain untouched for four or five hours. When this time has elapsed a cutting shape is laid on the back of the mount and the whole cut through to the glass with a sharp pointed knife. If the glass has been perfectly cleaned (the most important part of the process), and the print is quite dry, it should curl off the glass, bearing the collodion film with a polish equalling the surface

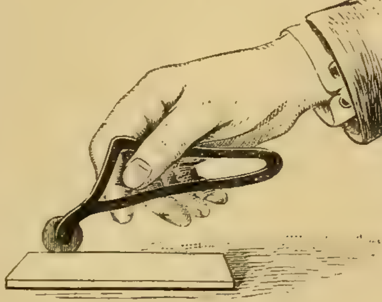


FIG. 68.—ROBINSON'S TRIMMER.

of the glass. Should the print show no inclination of leaving the glass it should be again placed near the fire for some time, after which, if it still remains fixed, one of the above faults will be the cause of its adherence to the glass.

We now come to the conclusion of the present series of papers. Although these have occupied some twelve fair-sized articles, but a very small fraction of photography has been treated upon. Simple as photography may seem to those who have studied only its elements, to acquire a perfect knowledge of every branch of the science would require more than man's allotted years—all its branches extend so far into other sciences, arts, and mechanics—that it could never be learnt by a single person "from beginning to end." The enthusiast having made himself thoroughly proficient in the ordinary course of an amateur photographer's work, should select some branch of the science most suitable to his tastes, confine his experiments to that line only, and having followed it up with progressive steps to its present state, endeavour with his experience and labour to perfect it, for no portion of photography can yet be called *perfect*. It is in this manner almost all great discoveries and inventions are made.

Study carefully every book or periodical on the art that can be purchased, learn perfectly the first lessons of the art before attempting more advanced work, and keep a memorandum book in which to set down any scrap of information or formulæ come across in the literature of photography that will, or may be, of value in the future. The wealth of practical recipes — "just what I wanted!" — that lies buried in the pages of back volumes is enormous; but, if rigorously culled from the mass of other matter as soon as discovered, and placed in a little book, duly paged and indexed, it can be referred to at any time, when otherwise it would be glanced over when of little use, and never seen again—"lost to sight and memory dear."

In England there are five journals published devoted solely to the subject of photography. Two of these, the *Amateur Photographer* (weekly, 2d.) and the *Camera* (monthly, 6d.), are published for the benefit of amateurs; other two, *British Journal of Photography* and the *Photographic News* (weekly, 3d. each), are semi-professional; while the *Photographer's World* is issued only to the profession.

Two of the above issue annually an almanac or compendium of the past year's doings: they are known as the "British Journal Almanac" and "Photographic News Year Book"—both at 1s. each, and both containing a fund of information worth five times that amount. In America several journals and almanacs are published; the *Philadelphia Photographer*, issued semi-monthly, at 30 cents, being the best, as every number contains an example of first-class photographic work, printed either on albumen paper or by one of the many photo-mechanical processes. To describe the characteristics of the principal English and American photographic books would occupy too much space here; but I may contribute a short paper on the subject in some future number of "ours."

I cannot resist quoting, as a final scrap of advice, the concluding paragraph of the preface to my little book, "Practical Amateur Photography": "Let me advise the amateur, if he wish to be successful, to make up his mind at the commencement not to be beaten: get to the bottom of everything, and don't be disheartened at non-success—*there is more to be learnt from failures than from successes.* Failures, at times, are certain to occur; when they do, do not blame instructions, chemicals, or apparatus; nine times out of ten it is the operator who is wrong: he should then find out where he *is* wrong, and when he has done so he will, perhaps, recall to memory the old proverb—*Experientia docet.*"

ELIZABETHAN FURNITURE.

WITH PRACTICAL HINTS ON ITS CONSTRUCTION.

By Rev. ALGERNON THOROLD, M.A.

VI.—Bedposts for Columns—Rail—Cornice—Top—Doors — Panels for Sides — Restoration of Colour—Staining for Uniformity of Colour —Hinges and Handles, etc. — Fastening Together—Putting in Back.

IN Fig. 10 the columns which show to such advantage in Fig. 1, are, it will be noticed, omitted, but in order only that the skeleton frame of the cabinet may be seen to greater advantage. Such columns, the measurements of which will be found in Fig. 36, are at times to be found in the shape of old table legs; but as it is somewhat improbable that we have made so good a find, we must turn up what we want out of an old bed-post, or even a beam. There are many fine patterns which can be utilised, and some are given in Figs. 37 and 38.

If we are compelled to turn up the columns for ourselves, we must not forget to do all the trimming, squaring, and planing necessary upon the upper and lower parts at A and B, before carrying them to the lathe; if left till last, we shall run great risk of injuring the turned work. When the lathe work is finished, two mortises must be cut, open at the top, as shown in Fig. 34, to carry corresponding tenons in

C C and G G, Fig. 10. The foot, B, drops into I, Fig. 29, cut to receive it, in the shelf.

When we have cut tenons at the end of C C, the columns may be dropped into position, and pegged temporarily through J in Fig 16.

We now proceed to the rail, G G, Fig. 16, which should have a groove ploughed along the inside face to carry the edge of a shelf which rests on the top rail, F, of the centre forming Fig. 14, its position will be seen on reference to Fig. 16, the groove following the dotted line, Q Q, of the frame.

This rail, G G, of which measurements are given at I, Fig. 16, may possibly be made of an old rail which has done duty on the front of a large chest; but in all probability we shall prefer to cut it out of planking, its prominent position requiring a good clean piece, besides which old thumb carving will look better than anything else, a light moulding only being run along the lower edge.

Still going up, we come to the cornice, lettered M, in Fig. 14. Sections of suitable cornices are given in Figs. 39 and 40. The ogee is the simplest form, and perhaps, after all, the most effective, because of its simplicity. A good form is exemplified in Fig. 39.

Having selected our wood, the task before us is one rather of labour than skill, though a certain amount of this is needful for obtaining a true curve, and we must go on working with our hollowing plane till the required depth has been reached. The corners must be cut in the mitre box, and for extra strength when fastening them together, iron brackets should be screwed into the angles; the two back ends, A A, of the two sides are connected by a cross-rail, B, all being dovetailed together.

The part lettered N, in Fig. 14, shows a heavy slab of oak, which forms the top of the cornice, and is constructed of well-planed planking, glued and tongued together. Strong cross-pieces should be screwed upon the under side of this slab, to prevent warping. When finished, it should project half an inch beyond the cornice, both in front, and round the sides, and is fastened upon it by means of screws and blocks on the under side. Before the cornice is dropped into place on the cabinet, small blocks should be screwed upon the inside of the rails, Fig. 16, projecting upwards, to keep the cornice from sliding from its position.

The cornice and top being out of hand, we may now come to the doors, Figs. 41 and 42. It will be observed in these that the perpendicular stiles, A A, carry the cross rails, B B; also that the cross rails are narrower than the perpendiculars, and are moulded on the two inner edges opposite to each other, while the perpendiculars are but slightly chamfered on their inner edges with a round moulding down the centre.

To make the frames of these doors, we proceed to rip out strips from a good plank, and work them up to the measurements given in Figs. 41 and 42. Then we go on to plough a groove for the panels, along the centre of one edge of the strips, cutting also tenons and mortises, as shown at A and B; slip in the panels when ready, peg the rails together, and the doors are finished.

Nothing has been said hitherto about the upper panels for the sides, which, on measurement, will be found to be larger than the rest. These, and we shall require two, one for each side, must be constructed out of such other panels as we have, but a good strong job may be made by carefully shooting the edges of two panels, and gluing them together, screwing cross-pieces also at the back, as shown in Fig. 43.

All the parts of our cabinet being now completed, we may proceed to take it to pieces, for what to many will be the pleasantest part of the work.

The rough carpentering being over, with the somewhat tedious planning and fitting, it only remains to call in our artistic powers as carvers, and it depends, of course, a great deal upon what our old pieces are like, whether much or little is required of us in this respect. If the rails and stiles used in our work have already done duty, the mouldings upon them, in flats, rounds, and hollows, will serve as a guide for the parts we made for ourselves, and which are still plain. All the rails and stiles should have mouldings along each edge, and Figs. 44, 45, and 46 show in sections what is usually found in old wood. The majority of such designs can be run on any new work by the use of the snipe's bill and the usual hollowing and rounding planes. Figs. 47 and 48 show designs for carving suitable for the perpendicular side rail, or legs of the lower part. Figs. 49 and 50 show thumb and other carving suitable for the upper front and side rails. Fig. 51 shows design for panels. Figs. 52 and 53 show designs for hinges and handles. When such carving and moulding as is needful is finished, we m y proceed to restore the colour of our oak, and there is no better means than the free use of linseed oil, rubbing and brushing. We must not expect the deep colour to appear as by magic, but the continuous use of the above means will eventually bring up the grain, and with it a satin-like surface, soft as well as bright. The parts of our cabinet, however, which have been made out of newer, and, perhaps, different coloured wood, must be brought to the same colour as the rest by means of oak stain. Great care should be taken in doing this, and thin coats only should be applied at a time with a brush, and rubbed in with a sponge. It will be a good plan also to apply a little to the entire cabinet to tone every part to one shade. Of course, all this must be done before any oil at all is used. The best stain is made by dissolving Fowler's

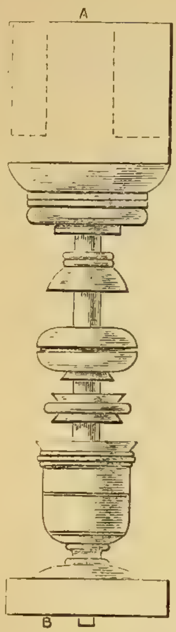


FIG. 36.—TURNED COLUMN.

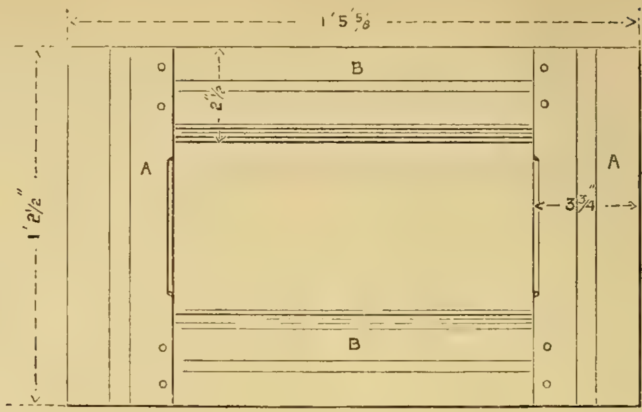
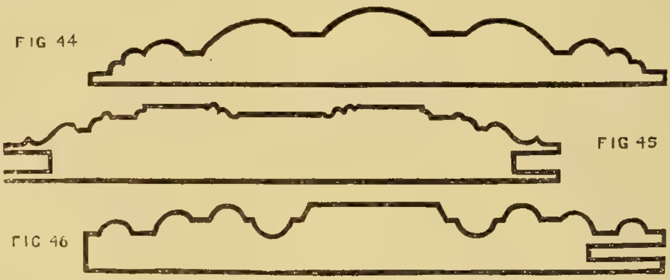


FIG. 41.—FRAME FOR DOOR.


FIG. 40.—SECTION OF CORNICE.



FIGS. 44, 45, 46.—SECTIONS USUALLY FOUND IN OLD RAILS.

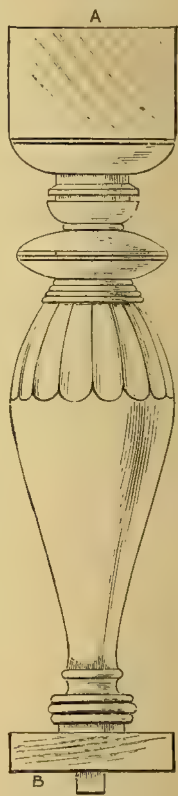


FIG. 38.—TURNED COLUMN.

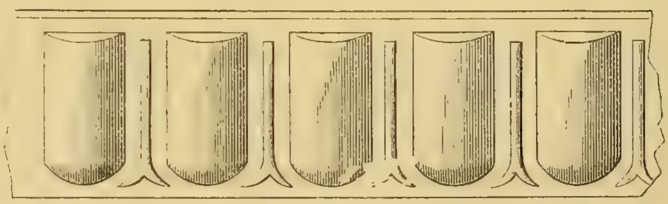


FIG. 49.—THUMB CARVING FOR UPPER FRONT AND SIDE RAILS.

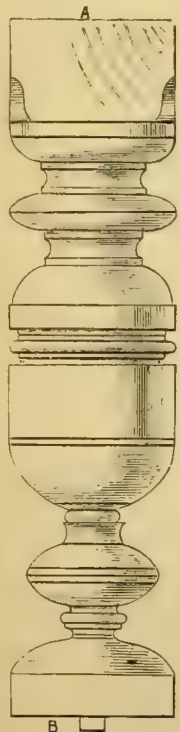


FIG. 37.—TURNED COLUMN.

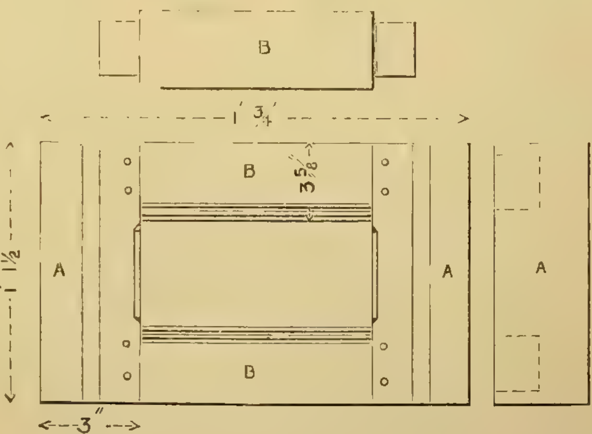


FIG. 42.—FRAME FOR DOOR.


FIG. 39.—SECTION OF CORNICE.

FIG. 50.—CARVING SUITABLE FOR UPPER FRONT AND SIDE RAILS.

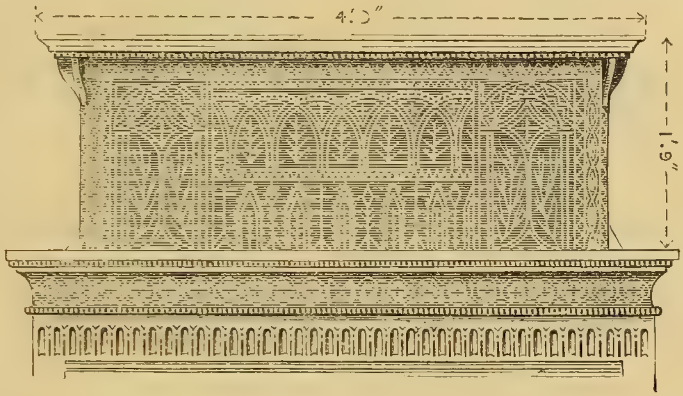


FIG. 54.—BACKING ON TOP OF CABINET SHOWN IN FIG. 1.

References to Letters in Fig. 55 :—A, Section of Top Cornice ; B, Carved 3-inch Bracket under each end of Cornice, with another at right angles to it ; C, Toothed work along Front of E ; D, Dentils along Front of F.

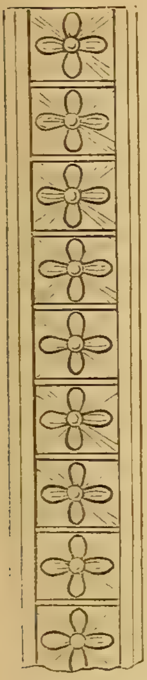


FIG. 47. — PATTERN FOR SIDE RAIL, OR LEG OF LOWER PART.

FIG. 48. — PATTERN FOR SIDE RAIL, OR LEG OF LOWER PART.

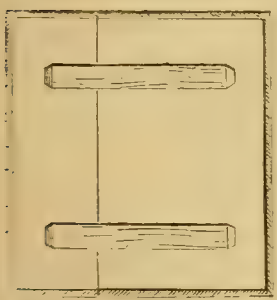


FIG. 43.—JOINT IN PANEL.

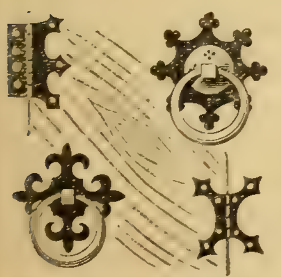


FIG. 53.—CABINET HINGES AND HANDLES.

FIG. 51.—DESIGN FOR PANEL.

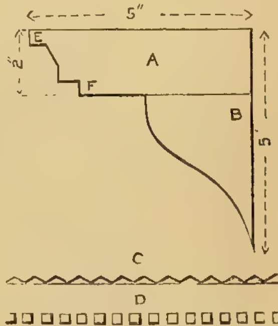


FIG. 55.—CORNICE AND BRACKET.

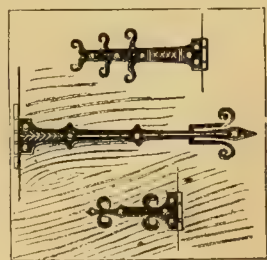


FIG. 52.—HINGES FOR CHESTS.

Cake Oil Stain in hot water, and applying it (cold) in washes till the proper shade is obtained. We must studiously avoid polish or varnish, these may afford a quick way of getting up the surface, but their use is a mistake, it is far better to wait a little longer for an oil finish. Of course, we must not wait for all this before putting our cabinet together, much of the oiling must necessarily take place long after that. When, however, we have done what we can in this way, we get the front, and sides, and back into place, not forgetting, however, to insert the panels, and finally drive the pegs home. This finished, we must take some match-boarding, which should be stained oak colour before using, and nail in a bottom and centre shelf, first of all screwing strips upon the inside of the long front rails, and $\frac{1}{2}$ inch below their upper edge to carry the boards; this will give immediate rigidity to the entire cabinet, and we can proceed to put the rest of it together, without endangering the joints. When the doors are hung, and all other small fittings completed, we may bring our labours to a close by fastening in the back. This also is composed of match-boarding, and should run perpendicularly. It will be remembered that the back rails were set $\frac{1}{2}$ inch in. It will, therefore, be found that the back will fall flush with the back perpendicular rails of the cabinet.

The back should always be put in as the last stroke, it being impossible to say what causes may arise making it necessary to get at the inside; but when once the back is fixed, the only entrance is through the small doors.

It may be laid down as a truth, which can hardly be gainsaid, that it is dangerous to attempt any improvements in the form and designs of specimens of the 16th and 17th centuries' furniture. Their original grace is so striking, and their beauty of line so simple and engaging, that alterations and additions seem almost like reflections upon their old designers; and, beyond this, very frequently the introduction of any novelty tends to destroy the characteristics of the old style, and transforms the antique into the mixed unauthorised version, which is so distasteful to the lovers of the old forms and thoughts of byegone times.

There are, however, occasions when a sudden inspiration compels us to override the most orthodox of rules, and we find that our own ideas, which, as a general rule it would be unwise to carry out, harmonize with someone else's, under practical treatment, in a manner we dared not anticipate.

This was the case in no small degree with the cabinet shown in Fig. 1, and upon which I spent much time and work.

The addition which I made with some distrust, accorded, however, so well with the rest of the cabinet, that it may be worth while to give the details.

Everyone may not, of course, be of the same opinion, and some of those who have followed so far may prefer to rest satisfied with what they have already done, and be content in the possession of a cabinet, the design of which is entirely after an old model. The extra work is movable, and can be easily put aside if, after all, our judgment of results should finally disagree. Fig. 54 shows this back on the cabinet.

The stiles and rails are tenoned and mortised together in the usual way, the panels being let into grooves, and inserted before the framing is pegged together. Upon the top rail is a cornice, of which Fig. 55 is the section. This cornice not only gives a finish to the back, but is useful as a support for china, as shown in Fig. 1. In Fig. 55 A is the cornice, B, bracket supporting it, C, notching along lower edge of E, and D, dentils in rebate F.

The back is kept in place by long flat irons, screwed upon both the back itself and upon the back of the side rails of the cabinet. This done, our Elizabethan Cabinet is complete, and all that remains is to put the finest oil polish on it that we can, and place it in the position where its beauty may best be seen. *(To be continued.)*

NOTES ON NOVELTIES.

By THE EDITOR.

68. MATERIALS FOR UPHOLSTERY. 69. GAWTHORP'S COMING EXHIBITION OF REPOUSSE WORK. 70. ACME VITRE STAINED GLASS. 71. ZILLES' MODELS FOR INTAGLIO WORK. 72. THE "ECLIPSE" TURNSCREW. 73. PARALLEL BENCH VICE. 74. NOVELTIES IN PREPARATION BY THE BRITANNIA COMPANY.

68. MATERIALS FOR UPHOLSTERY.—Messrs. Urquhart and Adamson, the House Furnishing Establishment and North of England Bedding House, 13 and 15, *Bold Street*, *Liverpool*, send me a great variety of patterns of different kinds of materials used in upholstery. Among these are French merino, blue serge, Turkey cloths of different qualities, Pekin cloth, various qualities of damasks and Triton cloth, Persian cord, drab moreen, diagonal cloth, striped, wool, and silk repps, silk and striped Terry, embossed, Utrecht, Genoa, and frisé velvets, and velvet woven in pattern, silk plush, ordinary and tapestry cretonnes, tapestry stuffs, Moroccos, roans, leather cloth, and black duck, with buttons, gimps, leather banding to be used like gimp, and for the same purpose, and hair for stuffing, in two qualities. All of these, I may say, are excellent and cheap, to judge from the prices submitted, but which would take up too much space to give *in extenso*.

The principal object that Messrs. Urquhart and Adamson have in view in sending these materials to me is to show amateur upholsterers who may have a difficulty in getting these things, and, what is equally important, getting them to their mind, where they may procure them, both good and cheap, and in the shortest possible time; and it is precisely for the same reason that I call attention to them. This will appear from the following letter which accompanied the materials, and which it affords me much pleasure to give verbatim here.

Messrs. Urquhart and Adamson write: "With reference to articles on upholstery in your magazine, we beg to hand you herewith some specimens of covering materials for review if you think them likely to be useful to your readers. They are not, as you will see, all of the newest or the most fashionable fabrics, but we think they are all excellent in their way. Of the materials mostly used at the present moment we have a very large variety of patterns from the looms of all the leading manufacturers. We shall be happy to send cuttings, etc., to any amateur who may write us either for patterns of special materials or for an assortment of various fabrics. In order, however, to check applications that may be made merely from curiosity, and in part to recoup us for time expended in cutting and preparing the samples, we cannot attend to any which are unaccompanied by stamps or P.O.O. for 2s. 6d. This, however, will be returned if goods are ordered. We will cut any length required, although some of the prices are under those of wholesale factors."

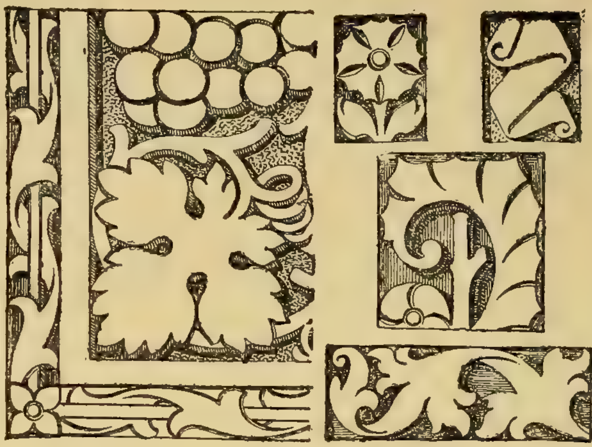
In my opinion, a very fair and useful proposal has been made to all readers of this magazine who may find any difficulty in getting what they want for amateur upholstery, and I trust that there are many who will take advantage of it.

69. *Gawthorp's Coming Exhibition of Repoussé Work.*—I am informed by Mr. T. J. Gawthorp, Art Metal Worker, 16, *Long Acre, London, W.C.*, that he intends to hold, in February, 1888, at the above address, and under distinguished patronage, his Second Exhibition of Amateur Repoussé Work. The awards on this occasion will be made by Alfred Gilbert, Esq., A.R.A., assisted by a Committee of Practical Workmen. It is to be hoped that many readers of this Magazine, who are noting and following the able and thoroughly practical instructions of Mr. Lancelot L. Haslope, will be induced to compete for the various Silver Medals and Badges, Bronze Medals and Certificates of Merit that are offered by Mr. Gawthorp. Intending competitors should write to him at once for the List of Classes and Awards and Form of Entry. Rules and regulations for the instruction and guidance of competitors accompany the List of Classes. Unfinished exhibits must be sent in early in January, 1888, and finished exhibits not later than January 31 in that year.

70. "*Acme Vitre*" *Stained Glass.*—Many processes for imitating stained glass have been brought before the public during the last three or four years, but I am inclined to think myself that none of them afford so close and brilliant a method and means of effecting the imitation as the process which it has pleased the inventor to style "Acme Vitre." Moreover, in addition to the charm of closeness and brilliancy, the invention is so elastic in its principle, as I may term it, that it permits the amateur to follow his own fancy as to the design itself, and to use his own taste and inclination in colouring it, that it far surpasses in this respect, in which the decorator is tied down to printed designs by another hand, and in which the whole art lies in placing them neatly on the glass to be coloured, and in such a manner that the applied sheet may lay flat on the surface of the glass without fold or wrinkle. Not so with "Acme Vitre," in which design and colouring may be entirely the work of the amateur himself, unless he choose to vary his paintings by the introduction of photographs of figures, landscapes, etc., as centres which can be rendered transparent. Supposing that it is wished to colour any window by this process, the first thing to be done is to obtain sheets or panes of glass cut to the size of those in the window, and it may be as well to see now, that after the design is placed on the glass and coloured, the painted glass is to be placed in the window, with the decorated side inwards against the original glass, and fixed in its place by means of pins, putty, or a narrow bead.

On opening the box of materials, which is supplied for 2s. 6d., the operator will find six bottles of stains—in the box sent to me these were orange, yellow, blue, brown, green, and red, but other colours can be had separately, as well as these, at 6d. per bottle—a camel-hair pencil, a set of black strips, to imitate the leading in stained glass; six packets of different shapes, such as rings of various sizes, diamonds, and leaves of artistic forms, also in imitation of leading; a sheet of black design paper, which will enable the amateur to make any shape not given in the packets; a sheet of suggested designs, most useful to those who require assistance in this way, and directions for use, which are much as follows:—"Arrange the design cut of shapes supplied; if others are required, such as vases, etc., they should be pencilled on the plain sheet, then folded in the centre, and cut out so as to make both sides exactly correspond; branches of plants, etc., should be cut out as desired. The design arranged, moisten the adhesive side and press evenly on the glass; after this, place a sheet of paper over the design, and rub, so that every part adheres closely to the glass. This done, allow it to dry thoroughly by leaving it for some hours, then lay the glass on a flat surface, under which place a sheet of white paper, and apply the stains, with a camel-hair brush, to the various open spaces you have on the glass; well wipe the brush with a cloth, or clean it with turpentine, between each colour. Do not use the colours too sparingly, but put sufficient on so that they flow evenly over the surface. The glass should be left on the flat surface for a few hours to dry; then it can be removed, but should not be handled much for a few days until quite hard, when it can be fixed in the place it is intended to occupy. In the event of mishap with any portion of the work, clean that portion off with a rag and turpentine, and decorate it again. These stains may be mixed with advantage for producing a variety of colours."

The process is in itself easily carried out, and is very effective when done. The only thing for which I cannot vouch is the permanency of the colours, as this can be

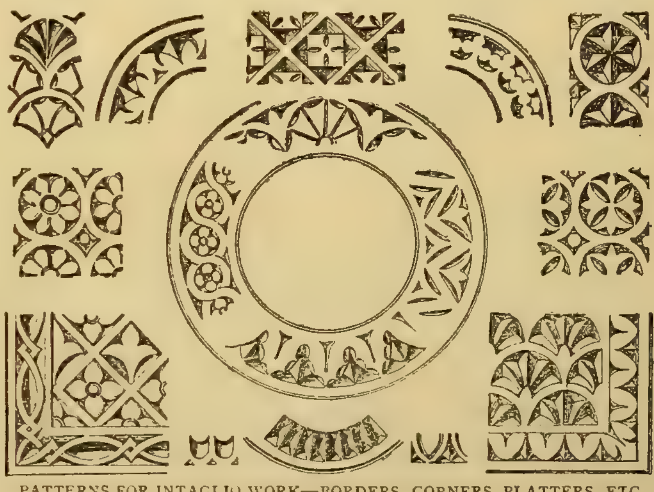


PATTERNS FOR INTAGLIO WORK—CORNERS, BORDERS, ETC.

determined by time alone, and exposure to light. The specimens of the work which have been shown to me, and which have the appearance of having been done some time, are bright and fresh in colour. The materials are supplied by Messrs. Richford and Co., "*The Red House*," 149, *Fleet Street*, opposite the *Daily News* Office. It is well worth while for amateurs to look round Messrs. Richford and Co.'s Novelty Warehouse when in *Fleet Street*, at any time, for they have hundreds of novelties on view, some of which are useful, some ornamental, but all attractive. Messrs. Richford and Co. have, for example, the best and cheapest Trousers Stretcher I ever saw, sent post free by parcel post for 1s. 3d. They also supply the "Companion" Lathe and Fret Saw, case included, at 56s.

71. *Zilles' Models for Intaglio Work.*—If I were asked to point out the man whom I considered to be the most earnest and zealous in the prosecution of his business in this exceptionally busy generation, I think I should have to request Mr. Henry Zilles, of 9, *South Street, Finsbury, London, E.C.*, to step to the front. Scarcely a week passes but I receive something from him in the shape of a new design, a new catalogue, or a new appliance for art work; they come in so quickly—in fact, treading rapidly on one another's heels—that I am hardly able to notify them to my readers with sufficient celerity; and now I have to speak of something from him which is a novelty to myself, and will prove so, I imagine, to many, if not most, of my readers. This consists of patterns for the assistance of amateurs who have a desire to ornament their work with carving in *intaglio*, which, I need scarcely remind my readers, is carving in which the design is hollowed out or sunk below the surface, in opposition to carving in relief in any form, whether high or low, in which the design is raised above the surface, which is produced by cutting or the use of the router, at the desired depth below the original surface of the wood. "Intaglio work," writes Mr. Zilles, "having found especial favour with amateur carvers lately, owing to the neat appearance of such articles when finished, and in consequence of the few difficulties in the way of doing such work, I have had some castings of plaster of Paris (gypsum paste) made, in order to give amateurs a systematic way of acquiring this art of flat carving. Four different plates (or casts), each of which has a variety of designs for borders of butter plates, napkin rings, caskets, etc., can be had, price 2s. 6d. per plate, postage 3d. extra. Lime and pear are the best woods for beginners to use; walnut and holly for advanced carvers." I have had the pleasure of seeing the four plates spoken of by Mr. Zilles in his letter, and can recommend them to the notice of my readers, as they afford sharp and clear examples of the finished work, and are further useful in suggesting the mode and manipulation of the tools by which the work is produced. Some of the patterns are shown in the annexed illustrations, and from these it will be seen that the work is at once effective and easy of execution. I may add that I have received from Mr. Zilles his List No. 36, price 2d., which gives a description of the illustrations in Lists Nos. 31, 32, 33, 34, 35, and cancels List No. 29. I note that there are 800 engravings in Lists Nos. 31 to 35 inclusive, of which 170 are new.

72. *The "Eclipse" Turnscrew.*—This is a new turnscrew, which is offered for sale by the Britannia Company, *Colchester*, and which may be seen and handled by amateurs at the Company's new show-rooms, 100, *Houndsditch, E.C.* The demands on my time have not permitted me to put in an appearance there, and therefore I have not been able to look at the tool in question; but from the description which the Company has sent me, and which they say is very explicit, I have no doubt at all of the handiness of the screwdriver, and that it possesses advantages which other kinds cannot boast of. Briefly stated,



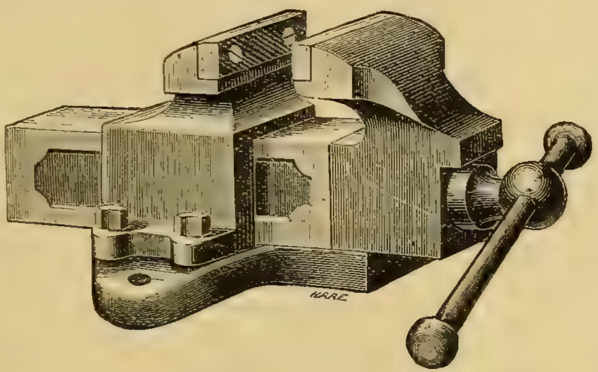
PATTERNS FOR INTAGLIO WORK—BORDERS, CORNERS, PLATTERS, ETC.

they are these: By a simple alteration of the button at the butt-end of the handle, the same motion of the hand either draws or drives a screw. One hand only being required for the operation, the driving or drawing of a screw in awkward corners, or in places inaccessible to both hands, is easily effected. With an ordinary turnscrew, when working with the right hand the left is called into requisition to steady the tool, especially when shifting the handle in the right hand. Inasmuch as in using the "Eclipse" the handle never requires to be shifted in the hand, all this is obviated. The motion being continuous, all steadying and shifting being dispensed with, any work can be much more speedily effected than with an ordinary turnscrew. The blades are made of the best material, and being keyed to the gear inside, the handle cannot draw or work loose, as in ordinary turnscrews. The interior gear being externally simple and indestructible in working, will not break, however great the strain put upon it. The Company do not state the price of the tool, but it will, doubtless, be supplied in different sizes, which will, as a matter of course, be sold at different prices. With regard to the mode of using it, a small button, already mentioned, will be noticed in the accompanying illustration, fitting into a slot in the metal band which encircles the thick end of the handle. There are three V slots into which this button may be placed. When it is in the centre one, as in the illustration, the tool is an ordinary turnscrew with a fixed blade. When the button is in the left-hand, or lowest, slot, referring to the engraving, the turnscrew is set for driving screws; grasp the handle firmly, and turn it backwards and forwards by a motion of the wrist. When the button is in the right-hand, or uppermost, slot, the turnscrew is set for drawing screws. The same wrist motion to be used.

73. *Parallel Bench Vice.*—All the specialties of the Britannia Company may be seen at 100, *Houndsditch, E.C.*, and therefore any intending buyer can satisfy himself with regard to the suitability of the tool he proposes to purchase. Those who are in want of a good bench vice should have a look at the Company's Parallel Bench Vice, with steel jaws, made in three sizes, which, with prices, are as follows:—

							Weight.	Price s. d.
No. 1—Measure across jaw,	2¾ in.	will open	3¼ in	...	11 lbs	...	10 6
2	,,	,,	3¼ in.	,,	4 in. ...	18 lbs. ...	17 6
3	,,	,,	3¾ in.	,,	5 in. ...	29 lbs. ...	25 0

As the form, character, and working of the vice are very clearly shown in the accompanying illustration, no further description is needful.



BRITANNIA COMPANY'S PARALLEL BENCH VICE.

74. *Novelties in Preparation by the Britannia Co.*—I am enabled to tell my readers that the Britannia Company have now in progress a new fretsaw, in which are embodied several very important improvements and modifications. Although it will have a true vertical stroke, which is essential to smooth work, it will have no spring to overcome. There will be two speeds on the flywheel to adapt it for metal cutting for inlaying, and it will be a tool possessed of more power than the saws at present in use, without extra cost. Further, as very many readers of AMATEUR WORK have asked for a really serviceable lathe at a very low price, the Company have put in hand a considerable number of a new lathe, with 5 inch centre and 3 feet 6 inch bed, which they propose to offer at £4 4s. The Company have found so many who would like to purchase a lathe, but who would not go to the price even of a second-hand lathe, that they have determined to place in the market a properly constructed lathe, capable of turning out fair-sized work, at the low figure named, feeling confident that if an amateur set to work to make a lathe for himself, he would find, in the long run, that it would cost him more than it would to purchase the lathe which the Company are now preparing. Further notices will be given, with illustrations, of these novelties when they are ready to send out. Reverting for a moment to the promised cheap lathe, it will be, of course, complete in itself, and on standards of regulation height. I will venture, however, to suggest to the Company that there are many amateurs who are pinched for room, and who would be glad to have it in the form of a bench lathe, or lathe to be placed on and removed from the ordinary carpenter's bench at pleasure. If the Company can contrive to give amateurs the benefit of the alternative form, they would enhance the value of the boon they are now bestowing on them.

THE "ECLIPSE" TURNSCREW.

AMATEURS IN COUNCIL.

For "Instructions to Contributors and Correspondents," see page 44 of this Volume, or Part 60, page 44.

India Rubber for Stamp Making.

"CEEVIL" ENGINEER.—I cannot repeat directions for Rubber Stamp Making, as they are already given at length and in detail in Vol. II., pages 332, 421, otherwise Parts 18 and 20, which can be procured at 6d. each. Proper rubber for stamp making may be obtained from Messrs. Richford and Co., *The Red House*, 146, *Fleet Street, London, E.C.* Mention the name of this Magazine when you write for it. It would be utterly useless to describe the chemical process to which you refer, and to which an allusion was made in page 382 of this volume. You would have to spend pounds in getting the necessary plant for the production of an article that would only cost a few pence if you have it done for you. Write to the DIRECT PHOTO ETCHING COMPANY, 85, *Farringdon Street, London, E.C.*, and they will do anything for you in photo-zincography.

Chain Gear for Foot Lathe.

LIMDEN writes:—"I am anxious to use my lathe (3½ inch centre), for boring metal, turning, and drilling. Finding that a gut band always slipped when there was much work, and not wishing to go to the expense of a flat fly-wheel and cone pulley, I sent to Sheffield for some chain and two spurwheels, and put one behind the pulley and one on the treadle shaft. The result was excellent. I can now drill a half inch hole, turn in iron or brass, and saw iron bars, for I wanted to cut off a piece from a bar 1 inch by ⅜ inch, and in this I was successful. Of course the chain is noisy, but I do not mind this as the advantage is so great. With respect to drills I can strongly recommend the fluted drills. I drilled a $\frac{3}{32}$ inch hole the other day through a ⅝ inch nut to put in a pin, and the hole was true and clear. As the fluted drills are not so greedy as the twist, there is not so much danger of their breaking off."

Windmill Making.

LIMDEN writes:—"Any hints as to windmill making will be very welcome. I am getting on with one (four sweeps, each 4 feet 6 inches by 2 feet), to pump water, but I find it hard work, as everything must be so strong to stand the knocking about." —[It is difficult to gather from this in what respect you really require help. All I can say at present is: Make every part sufficiently strong to stand the knocking about. If, however, you will write again and say in what special points you require help, every endeavour shall be made to assist you.—ED.]

Low Pressure Motor.

STADT DRESDEN asks:—Can you tell me if there would be any probability of finding a few purchasers of a low pressure motor, such as I spoke of in page 335? I find the cost of making the pattern of the cylinder so prohibitive that unless I can sell three or four of the complete machines, I shall have to abandon the idea. At present I am unable to finish the designs of motor, as I am making an improved planer, for hand, foot, or steam power, which I will perhaps patent. This machine must be completed first. The power of the motor would be about 1 horse, and could be worked up to 1½-horse power.—[I cannot say whether or not any one would purchase your low pressure motor when made. I think any intending buyer would want to see it at work first, I should. However, I put your query in print in case there may be any readers who would like to treat with you. —ED.]

Enlarging Camera.

A. K. writes:—"Mr. C. A. Parker says in page 382 that he will, with your permission, contribute papers on the construction of a Half-Plate Extension Camera. I hope you will arrange with him for their appearance, as it is just the thing I want."—[Mr. Parker is preparing these papers.—ED.] "I have made a capital enlarging board or table out of an old fashioned hall seat, it is twelve inches wide, and I have arranged it so that my enlarging camera is fixed at one end, and the easel is made to slide to and from it, being clamped where wanted by a thumb screw. This may serve as a wrinkle to others, I find it answer capitally. The height is fifteen inches, so I place it across two tables when in use."—[I have a paper in hand awaiting publication on a Simple Enlarging Camera for Amateurs, made on this principle.—ED.]

Fairy Incandescent Lamps.

COLONIST. — These are small electric lamps worn on the persons of "fairies" in theatrical performances. The batteries supplying the current to those tiny lamps are compact light cells made of insulite or ebonite, either fitted with thin sheets of lead to fit them for receiving a charge from a dynamo machine, or packed with cotton wool saturated with some saline solution. In the first form these batteries are tiny accumulators worn like a satchel or knapsack; in the second form they are small compact primary batteries worn in a similar manner. A very compact form is made to illumine jewels on the dresses of ladies, who can, by pressing a concealed spring, make those hollow jewels flash at will. These bijou lamps are worked with current from chloride of silver batteries, and are perfect little gems of finished electrical work. By using insulated wires it is quite easy to have several circuits on one battery, and thus more than one lamp. I have seen an announcement concerning these lamps in the price list of Messrs. E. and J. Dale, 26, *Ludgate Hill, E.C.*, who will doubtless be pleased to supply you with them.—G. E.

Making Leclanche Battery.

E. L. (*Esholt*).—It rarely pays an amateur to make up his own Léclanché cells unless he has some large batteries to maintain. Here are the directions in brief. Insert strips of carbon plate in the porous cells and closely pack them with a mixture of retort carbon and black manganese peroxide in fragments the size of peas, equal parts of each. This forms the charge for the porous cells. The strips of carbon must be first prepared in the following manner: Soak one and a half inches of each strip in melted paraffin, when this is cool score the end with file marks and cast to it a head of lead in which a brass binding screw is embedded. Dip this head whilst hot in Brunswick black and let it cool, then clean off black from brass screw. When the cell is charged seal it with a coat of melted pitch, and perforate this with two small holes. The charge for the outer cell is a half-saturated solution of sal-ammoniac. Other information in my articles on "Electric Bells" in latter parts of Vol. I. See also, "How it was Managed," page 427, July part of AMATEUR WORK. —G. E.

Cheap Electric Bell Battery.

E. L. (*Esholt*).—The trouble experienced by you with the zincs is a common one well known to all users of this battery. It is advisable, as a precaution against this excessive waste of zinc, to have the rods cast massive in the upper part, and to coat this part with Brunswick black. You cannot use the caustic soda or potash solution too strong, for you should have it saturated with caustic soda or caustic potash. See to it that the porous cell is securely sealed from atmospheric influence, for an admission of air to the cell will aid in fretting away the zinc at the surface of the liquid. —G. E.

Birch & Co.'s Lathes.

F. A. M. writes:—"I have just been to the Manchester Exhibition and seen Messrs. G. Birch & Co.'s beautiful lathes with medallion machine; that *is* beautiful work. The complete lathe costs £160, and I think I would rather have one of them than any other I have yet seen."—[Possibly so when a man can afford to spend £160 on a lathe, but this seems to be a great deal of money to lay out on a mechanical appliance, even if one is a skilled turner. The poor amateur—I speak relatively—must perforce be content with a lathe that costs as many shillings, or even less.—ED.]

Hallewell's Castings.

F. A. M. writes:—"When at Manchester I went to see Hallewell's drawings and castings of small engines, and found them much better than any others yet seen. Mr. Hallewell's address is 50, *Hanover Street, Dantzic Street, Manchester.*" —[Readers, please note, F. A. M. is a safe and sure guide in all matters pertaining to turning and engineering.—ED.]

Pianoforte Repairing.

CARPENTER.—You will find help in the papers about to appear under this heading in the September and October parts, in continuation of the first of the series by Mr. J. H. Moody, which appeared in page 146 of this Volume, otherwise Part 63, February 1887.

Zinc Fern Cases.

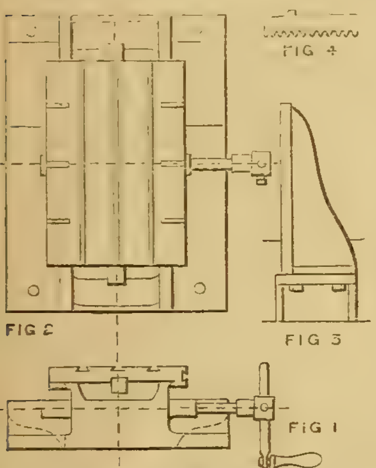
A. M. (*Aberfeldy*).—You will find many good designs for zinc ferneries in the papers entitled "Ferneries: How to Make Them and Manage Them," by Donald Bede, in Vol. II. of this Magazine. For further particulars see reply to J. P. respecting Aquariums, in page 479, or Part 69.

Cutting Letters in Stone.

W. H. S. (*Crewe*).—Arrangements have been made for a paper or two on this subject at some future time when space will permit.

Another Hand Planer.

STADT DRESDEN writes: —"In page 335 of this volume H. H. D. B. gives two fresh sketches of his proposed planer. His last idea to make the uprights of round bars will also prove a failure if tried. It is of no use to put a stay to the top of the vertical rod, there wants to be one in the middle of it also. The uprights shown on page 140 would do very well if the bottoms were simply flat instead of being a right angle. For small machines a solid web, at the back $\frac{3}{8}$ inch thick, is better than the cut out arrangement shown. The plan of raising the cross-slide by a central screw is adopted by some makers, but it cannot be recommended for obvious reasons. In page 382 H. H. D. B. seeks to improve his machine with an iron bed, but unless he abandons the round rods it will be no better than the wooden one. The bars, A A, are an improvement, but there does not appear to be any means other than the round rods to hold the table down on the bars; as a consequence, when the rods vibrate the table will chatter on the bars, and gashed work will be the result. A planing machine, to be of any use, must not spring $\frac{1}{100}$ inch in any slide, or it will most assuredly leave a mark on the work. I should fancy from sketch in page 335, the piece, G, has the cross-slide bolted to it, that had better be abandoned, as the further the cutting tool projects from the uprights the less efficient is the machine. As to cost I side with Mr. Balck in that. I take it H. H. D. B. wishes to plane eighteen inches long by about twelve inches wide; the bed casting sketched in page 382 must therefore be thirty-eight inches long, about twenty inches wide over the brackets, and about twelve inches deep, and the metal $\frac{5}{8}$ inch thick to prevent shaking. The casting would weigh about 60 pounds, and cost about 7s.; the table would weigh about 40 pounds, and cost 5s.; the round rods, two inches in diameter, would weigh about 56 pounds, and cost, if of iron, about 12s.;—total weight, 156 pounds; total cost, 24s. On the other hand, a bed made in the usual way with the flanges would be about twelve inches shorter, four or five inches shallower, and the metal $\frac{1}{8}$ inch thinner, would weigh about 50 pounds, and cost, say, 6s.; the table would weigh about 30 pounds, and would cost, say, 3s. 6d.; the cost of planing bed, if flanges were one inch wide, would be 5s. 6d., and for table, 4s.; total weight of castings, 80 pounds, cost 9s. 6d.; planing, 9s. 6d.; total cost, 19s. I take the cost of the cast iron at about 12s. per cwt., and the planing at $\frac{1}{4}$d. per square inch. I would recommend making the flanges or slides of the bed one and a quarter inches wide, it would add about 1s. 6d. to the cost of planing, but would make the machine wear better. An adjustable handle, as shown in Fig. 1, is better than an ordinary fixed one. The sketches represent a bench machine, the dotted lines in Fig. 1 show the form of an independent one to stand on iron standards. The machine in this latter case will be steadier if the legs are made to lean towards it at angle of ten degrees from the perpendicular. I would make the ends of rack as at Fig 4 in enlarged sketch, as by this means the holding screws are relieved of some strain. For holding the vertical slides or uprights the strongest and steadiest way is by two $\frac{5}{8}$ inch bolts underneath the bracket, as in Fig. 3. V slots are better than the ⊥ slots, and not so liable to break; they also don't cut into the metal so much. The slots are best running from end to end, as then they can be planed when the machine is finished. At the end of the table sheet iron pans extending the full breadth, two inches wide and half inch deep, should be fitted to catch the chips. These are usually cast solid with the table, but with such a small machine separate ones will be more convenient."



BENCH PLANING MACHINE.

Fig. 1.—End Elevation, showing Adjustable Handle. Fig. 2.—Plan. Fig. 3.—Mode of Holding Uprights. Fig. 4.—Rack.

Guide for Grinding Metal-Cutting Lathe Tools.

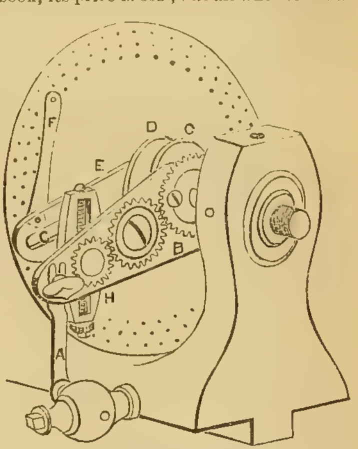
A. F. C. (*Madras*) writes:—"I have just adopted a very simple and obvious guide for grinding the faces of lathe tools for turning metal, and find it such a comfort that a hint of it may perhaps be acceptable to some of your readers. It consists simply of a block of hard wood, planed truly flat above and below, and having the upper surface sloping at an angle of 87° from the perpendicular. Upon this I rest the tool firmly, and press the whole against the side of the grinding wheel. The face is thus ground evenly to an angle of 3° from the perpendicular when the tool is in the holder. My wheels are not mounted upon spindles, but each on a separate chuck screwing on to the nose of the lathe-head. I can thus get at the side of the wheel without difficulty, and the wheels are dismounted with greater ease than when spindles are used. My performances have vastly improved since I adopted this very simple arrangement, and my pleasure in working has increased in proportion."

Hammocks.

J. H. E. (*Shepherd's Bush*).—I have a paper in hand on Hammock Making, which will appear as soon as room can be found for it.

The Compensating Index.

A. F. C. (*Madras*).—When you ask for a description of the compensating index for the equal division of the ellipse, you ask rather a hard thing. It is described in Vol. V. of Holtzapffel's work, but no explanation of the mathematical theory on which it acts is given, and I am not myself well enough versed in mathematics to work it out. I fear, too, the appliance could not be sufficiently described in a short paper, and that the Editor would deem a long one on so advanced a subject out of place at present in our magazine, seeing that, till now, we have hardly advanced beyond the first steps of ornamental turning. I am glad, however, that you are asking for information on these subjects, as I have in preparation some papers on some of the different appliances you mention, which I hope may prove acceptable to the readers of AMATEUR WORK. The accompanying illustration is copied from page 397 of Vol. V. of Holtzapffel's most excellent book, its price is 30s., but all who do ornamental turning should obtain it. Mr. Evans' book costs 21s., and it is, too, a good one. The holes or ornaments when spaced by the circular division plate upon an ellipse come too close together round the ends of the figure and too far apart upon the flatter sides of the figure. We require then to construct an index that shall increase and diminish in length twice during every revolution, and yet every joint must be so perfectly fitted that there shall not be the slightest shake. The lower half of the index, A, is attached to an arm, B, by a thumb-screw; the arm is detachable, and, as seen, is screwed to a permanent flange or plate, C; upon a second flange, D, is screwed a second arm, E, and the upper end of the index, F, is articulated to the end of this. Thus far, E might turn round the mandrel on its flange, D, but through the end of the arm, E, there is a slot, and in this slot, G, there works a pin, proceeding from a slider in the frame, H; the position of this slider being regulated by a screw with milled and divided head, seen below. The frame, H, makes two revolutions to one of the mandrel, being driven by the three wheels of 60, 60 and 30 teeth,



COMPENSATING INDEX FOR DIVISION OF THE ELLIPSE.

seen on the fixed arm, B; if the slider and pin be central the two arms, B and E, will act as if fixed together, and the index halves, A, F, act as an ordinary one of invariable length. When an ornament is being worked upon an ellipse the slider and pin are moved out by the micrometer head of the screw, more or less, according to the proportion between the major or minor arcs of the ellipse. Mr. Evans does not greatly recommend this apparatus, because a careful workman can manage to space out his work equally by the eye, by watching to see that the circles or beads touch, and if not, correcting them by the adjusting index before deepening the cut. I have not myself seen one of these appliances and do not think many of them have been made. —F. A. M.

Model Engines.

ELECTRICIAN (*Brixton*).—Mr. D. Hughes has given up his premises at *Kirkdale, Liverpool*, and at present, while I am writing, I cannot give you his new address. I have, however, asked for it (see page 432), and when I am furnished with it I will give it. Meanwhile, why not try Hallewell's castings, recommended by F. A. M. in page 526?

Dulcimer Making.

E. W. W.—No. 9 is the thinnest of the three sizes pianoforte wire mentioned in the article dealing with above subject. The instruction to begin stringing with that size at the bottom or bass end of the instrument, is probably an error that escaped the author's scrutiny, or, may be, confusion occurred in the figures. The stringing of a pianoforte is began at treble end, with a set of thin wire, and is continued with sets of stouter sizes bearing higher numbers, until the bass or covered strings are reached; and I see no reason for departure from that procedure in an instrument so near akin to the pianoforte as is the dulcimer.—J. H. M.

Violoncello Making.

E. H. A. (*Brighton*).—The paper to which you allude appeared in Part 65 for April of this year, or in page 275 of this volume. Is this the part that you have missed? It is a pity that any reader should miss a part. AMATEUR WORK is intended to be bound and preserved, and a volume with one part missing is at once depreciated in value owing to its incompleteness.

Grain Tin.

W. H. F.—Grain tin may be obtained, generally speaking, of chemists, if only small quantities are wanted. If anyone finds difficulty in procuring this material let him write to Mr. R. Bellamy, Family and Dispensing Chemist, *Bedale, Yorks*, who will help him.

INFORMATION SUPPLIED.

Cabinet Turkish Bath.

H. W. (*Newton Abbot*), writes in reply to R. H. (*Dover*), page 384:—"The measurements of a Cabinet Turkish Bath are as follows: Height in front 2 feet 8 inches; at back, 4 feet 2 inches; breadth in front, 1 foot 8 inches; at back, 2 feet 4 inches; at side, 2 feet 8 inches; breadth of flap at top, 7 inches. I had the idea of making one, but after mature deliberation, and in view of the necessity of all the joints, etc., being close fitting and substantial, I came to the conclusion that it was better and cheaper to give Messrs. Ellis & Co., 165, *Fleet Street*, £5 10s. for the complete article. I advise R. H. (*Dover*) to do the same; at all events, I can tell him that they were very obliging in answering all my enquiries, and no doubt would treat him equally well."—[A contributor who signs himself A. Sinus, but whose papers are by no means asinine, has sent me an article on the home manufacture of a Cabinet Turkish Bath, which will appear in the next volume.—ED.]

Waterpot and Oil Tin Bodies.

SEMPER EADEM writes in answer to H. S. W. (*Newport, Mon.*), page 432:—"Waterpot and oil tin bodies are not made the same size. A waterpot body is deeper than an oil tin. I herewith give you the different sizes of waterpot bodies that are made in our establishment:—

Nos.		in.	in.	Nos.		in.	in.
1	are cut	17 ×	6½	5	are cut	30 ×	11
2	,,	20 ×	7	6	,,	34 ×	12½
3	,,	24 ×	9	7	,,	40 ×	14
4	,,	28 ×	10				

All these sizes are so arranged to cut best out of the different sizes of tin plates."

Windmills.

LIMDEN writes in reply to ALPHA, page 432:—"I would advise ALPHA not to expect much benefit from wind as a motive power except for pumping, it is far too intermittent, and the largest windmill that an amateur could make (at a reasonable cost) would hardly do more than pump. Small windmill pumps are seldom seen in England, but in Australia and the States they abound. There are an immense number of different patterns made in the States, but they nearly all involve the use of complicated castings, which are not only expensive to make separately, but are also difficult to work up unless the amateur has machine tools and steam power to work them. Again, all the mills I speak of are made with governors of some kind or other, and, I may say at once, this requires an amount of work and elaboration that would raise the value of the mill when finished to a fancy price. I have been working at a mill for some time, and have gone thoroughly into the matter. I have abandoned all forms of governors entirely, and it must take its chance in a heavy gale, and I have done all I can to simplify the work. My mill has four wooden sweeps and sailcloth sails, each four feet six inches long and two feet wide; a Manganese steel one and a quarter inch crank shaft, with three inch crank running in plummer blocks, the blocks being on a wrought iron plate ⅜ by fourteen inches square. There is a circular hole in this plate and it fits round a four inch pipe. Through this pipe the rod passes from the crank to the pump, and the plate revolves round this pipe freely, so that when the wind changes and comes from another quarter it acts on a circular vane at the opposite end of the plate to the sails and sends the sails up into the wind again. There is a swivel joint between the connecting rod and the main rod which prevents the rods binding when the mill head goes round to the wind. The whole apparatus is supported by the four inch pipe, which is bolted to two nine by three inch deals, and these can be as high and as strongly supported as the position requires. The iron plate should have four strong wheels underneath, and should run on a wooden table fastened round the pipe, it will then be steady and better able to resist the thrusting action. Great care must be taken to make everything very strong, and the velocity and consequent vibration is considerable in a stiff breeze. If there is any other information I can give I shall be happy to do so, and if desired I will try to send drawings to scale."

INFORMATION SOUGHT.

Clock Dial.

TEMPUS wishes for instructions for re-silvering and lacquering the brass face of a fine old clock.

Sizing and Polishing Hemp, etc.

A. R. M. wishes to learn how to size and polish the various qualities of hemp, flax, jute, etc., for rope and twine making.

Freezing Machine.

ZERO writes:—"Will anyone inform me where I can get a description of a small freezing machine, as I am desirous of making one?"—[I am open to receive papers on this subject, and the method of making a cold chamber for keeping meat, fish, etc., in hot weather.—ED.]

Saw Bench.

H. A. S. writes:—"I should be glad to know if anyone has succeeded with the planing attachment of the saw bench described by OLLA PODRIDA in last volume of ours. At present the result obtained by mine is a succession of jumps, and not so well as I can do it on the bench. I should be quite satisfied to use mine entirely as a saw bench if OLLA PODRIDA will contrive a scroll saw (which I think he promised) to do work that would be too hard for the usual fret saws, and would also save smothering one's lathe with saw-dust."

Trumpeter Clock.

C. F. F.—Can anyone of "ours" instruct me how to make a Trumpeter Clock, the figure of which emerges from a pair of folding-doors, plays a fanfare and series of flourishes at hours and half hours? I am sure this would amuse many more besides myself.—[Will C. F. F. oblige me by letting me know the name of the paper on which he writes. It is not known to me, but its peculiar texture, resembling linen over which an iron has been passed, renders the surface desirable both for pen and pencil. —ED.]

LETTERS RECEIVED UP TO AUG. 2.

A YOUNG BINDER (No reply received for you yet); A. F. C. (*Madras*); GROOVED BARREL; H. S.; J. H. E. (*Shepherd's Bush*); J. W. A.; INCUBATOR; S. F.; H. J. W. (*Newport, Mon.*)

A ROUGH AND READY WAY OF BINDING MAGAZINES.

BY ARTHUR YORKE.

IN the following brief directions I disclaim all idea of entering into competition with the admirable articles by the author of the "*Art of Bookbinding*," which appeared in the first two volumes of this Magazine. From those articles I have derived much pleasure and information. By following the instructions given in them—with time and patience, and some outlay of money—the amateur may, I have no doubt, learn how to bind books in a superior manner. But there must be many who, like myself, can never hope to do this, and who would yet wish to know how to fasten their magazines together so as to be secure, readable, and neat, and at little or no cost. This I can tell them how to do. I have in my way bound at least a hundred volumes, and certainly have not spent a hundred pence in so doing.

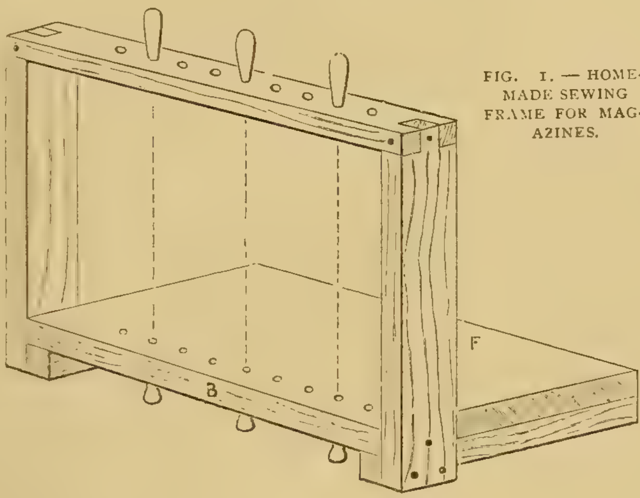


FIG. I. — HOME-MADE SEWING FRAME FOR MAGAZINES.

Having taken to pieces so many magazines as go to form my volume, I clean all glue, etc., from the backs of the sheets. Any illustrations, etc, on detached leaves I paste into their places on the sheets, and press out any creases with a warm flat iron, first slightly damping with a sponge, if needful. I then lay my sheets ready for sewing. Every sheet, no matter into how many leaves it may be folded, has at the foot of its first page a letter, which denotes its place in the book; the first sheet has A, the second B, and so on. A glance at the letter enables me to lay each sheet in its proper order, so that there shall be no hesitation about its being right when I begin to sew.

To form the fly-leaf and lining of cover at the beginning and conclusion of a volume, it is necessary to have *end-papers*. How to prepare these properly may be read in the articles mentioned, but for my "rough and ready way" I am content to take an advertisement sheet from the end of one of my magazines, and lay it at the bottom of my pile for the beginning, and another to lay at the top for the end of my book.

My sewing frame (Fig. 1) I made for myself, and anybody may make one. It is a piece of board as big as the *largest* book to be bound, mine is 12 by 9 inches, which will take *Punch*. Two upright strips are fastened to it, which carry a horizontal strip. A row of holes is bored through the latter, an inch apart, and corresponding holes are made in the board below. Tapes, ¼ inch wide, are used for sewing the book to. The number to be used depends on the size of the book; for AMATEUR WORK I use *five* tapes. Three only (indicated by dotted lines) are shown in the cut. I thread the top ends first, fix them with pegs, and then peg in the bottom ends, leaving about an inch loose below. The tapes have to be *perfectly* tight. I find it handy to have a piece of loose 1 inch board, to lay on the bottom of the frame; it brings the work to a more convenient height from the table, and is of use in other ways, which will appear further on. Round this board it is well to wrap a piece of waste paper, and upon it the first end-paper is laid with its fold against the tapes. As to sewing materials, I am contented with a large common needle, and stout and smooth ordinary thread, such as I can—as well as the tape—get for asking from the female members of my household. To facilitate explanation of the sewing process, I have marked with B and F, respectively the back and front of the frame, Fig. 1; and in Fig. 2 I have endeavoured to show that process. In this also I have drawn three tapes; this is for the sake of simplicity, but there are few magazines to which I should, in practice, put less than four. I work with the right hand in front, and the left at the back of the tapes. Taking the needle in the left, I pass it through the middle of the tape A (Fig. 2) where a knot secures the end of the thread, and through the end-paper, D. The right hand, which is *within* this paper, takes the needle and passes it out again just before the tape, B, is reached. Past that tape, it is again pushed to the front by the left hand, and the right once more pushes it to the back just before tape C. That done, I lay

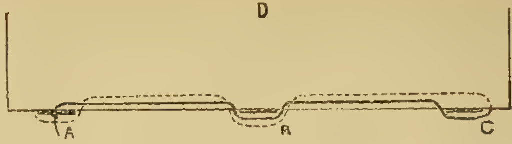


FIG. 2.—DIAGRAM EXPLAINING MODE OF SEWING.

the first true sheet of the book on the end-paper, and return the needle to the front through it just beyond C; and so work on backwards and forwards till the whole volume is sewn. It will be noted that the thread does not pass *through* the tape after the first stitch; in every other instance it only passes *behind* the tapes, and so loops the sheets to them. Also, that at each end tape the needle comes out (towards the back) through the sheet of which it completes the sewing; and having passed that tape, goes in again (towards the front) through the new sheet which is laid on to receive it. The course of the thread through the first end-paper is shown in Fig. 2, by the continuous line; its return through the first sheet, which is the same as in all subsequent sheets, is shown by a dotted line. The worker soon learns to use the two hands equally well.

The book being sewn, I lay a piece of board on the top, and on that a weight. This is to press the sheets as close together as possible, which being done, I brush some rather thin glue over the back, and on the glue attach a strip of thin muslin. The volume is then left under pressure for the night, that the glue may set properly.

That being effected the pegs may be removed, the book taken from the frame, and the loose ends of tape reduced to a uniform length of from two to three inches, according to the size of the volume. The piece of loose board laid on the frame tends to give a more equal length of tape to the two sides of the book than would be otherwise, also the waste paper wrapped round that board saves the frame from getting any share of glue in the operation of glueing the back. I now glue my tape ends inside the boards prepared as covers. Millboard, if one has it to hand, is the thing for covers; it is not costly, but I have never bought any for my rough and ready binding. Sometimes I have it, as parcels of books from publishers commonly come packed in it. Sometimes I use that which forms the material of boxes from the draper or milliner, or, if I have neither by me, I make pasteboard, which I like better. To do this I paste together a number of sheets of waste paper, stout brown forming the middle of my board, and something less coarse coming towards the outsides. By this means I can make my board as stout as I please to suit my volume. If my paper is thick, as it mostly is, I first damp it with a sponge, paste *both* pieces, squeeze out all air and superfluous paste with a warm flat iron, and put under pressure till next day, when I paste another sheet upon each side. So I go on till my board is thick enough, after which I keep it under pressure till dry and set, to avoid warping. At the present time I am covering most of my boards with a thin glazed brown paper (it cost eightpence a quire, and a quire would cover forty-eight such volumes as AMATEUR WORK), but I often use what would otherwise go as waste paper. After pasting the covering on my boards, and before ironing it down, I am careful to clean my iron by rubbing it on a piece of sand-paper.

After the tapes have been glued to the covers I leave the book under pressure for a night, and it is then ready for its back. It is well that the back should have been prepared a day or two before it is wanted. After trying various materials for this work I have found none in all respects so suitable as stout dark green window-blind holland. I find this strong, firm, and pleasant to the eye. I measure the width of the book-back with a slip of stiff paper that I may get just the curve which is desired. The few lines less than this, which would give the *exact* width, would make a flat back, which does not look so well as a bowed one on one's shelves, and I cut a strip of stiff paper of the measured width and of the length of the book-back. I cut the required piece of holland of the shape shown in Fig. 3, and up the centre of this, between the two lines drawn, I paste my strip of stiff paper and turn down over it the two little flaps at the ends, as indicated by the dotted lines, press it well down with a warm iron, and leave it to dry under pressure. A day or two later, or when I am ready for it, I paste the flaps at the sides over the covers of my book, turning the ends under. Again I leave the work to press. If I put holland corners to match the back, as I commonly do if the book is large, I paste them on before the covers are glued to the book.

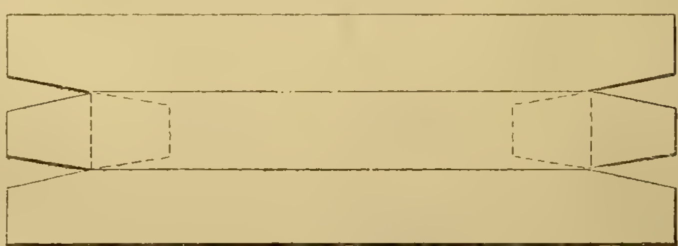


FIG. 3.—BACK FOR VOLUME.

There only remains to paste down, as a lining to the cover, one leaf of the end-paper at each end of the book, and

to put a neat label on the back. A light green paper for the latter looks best on a dark green back. If a label is to be permanent it should be an inch wider than the back of the book, so that half an inch may be pasted down on each side.

That magazines thus fastened together are in any way equal to volumes regularly bound I do not for a moment wish to assert, unless it is in the matter of opening: they open better because the binding is not so tight. But they are fairly durable, as much so as a cheap cloth case, and, to my taste, look neat and respectable; also, as the edges have not been ploughed or curtailed in any way, they are uninjured, and can at any time be taken to pieces and regularly bound if desired.

Such is my "rough and ready way." I have not followed binding as an art; with me it has never been more than an evening occupation—a something to employ the hands whilst listening to reading. Any one who chose to give more serious attention could, doubtless, improve on my methods, and especially if he applied to them some of the suggestions thrown out in the admirable articles above mentioned, to which the present paper only aspires to be a modest supplement.

UPHOLSTERY AT HOME.

By DAVID ADAMSON.

VI.—A SPRING-STUFFED SEAT.

SPRING seated small chairs are not now so fashionable as they were a few years ago; still there are some people who prefer them, and as it is entirely a matter for personal choice whether the springs shall be used or not, no instructions on upholstery could be considered complete unless they deal with spring stuffing. I think we may congratulate ourselves on the improved taste which recognizes the fact that springs in small chairs are not necessary to comfort, if, indeed, it may not be said that they are out of place for more reasons than one. Mind, I do not at all object to them for easy chairs and such like seats, where they are undoubtedly of service; only, for an ordinary small chair a particularly soft and yielding seat is not requisite. This may almost seem as though I describe how to make a seat the use of which I would discourage. It is, however, far from my intention to say that springs should not be used, but it should be with discretion, and it is merely their indiscriminate employment that is objectionable. From a utilitarian point of view it may be stated that a spring-stuffed seat is rather more apt to become sooner shabby and loose-looking than one upholstered by any of the methods hitherto described unless it has been well and carefully done. Not that there is any great difficulty in fixing the springs, or the need of particular skill. What is principally wanted is carefulness, and the avoidance of a slipshod or indifferent work.

May I remind readers that springs should not be used in the seats of so-called Chippendale chairs if their character is to be preserved; indeed, the same may be said concerning any chairs which are more than, say, fifty years old. Springs, it will be gathered from this, are of comparatively modern introduction; and though I have not been able to ascertain when they were first used, from what I can learn from upholsterers whose experience extends sufficiently far back, it may be taken for granted that they were unknown fifty years ago; indeed, I think we should not be far wrong if we assume that they did not come into anything like general use till a somewhat later date, for quite recently I have been informed by an upholsterer whose apprenticeship began some fifty-five years ago, that he remembers well when they were first employed. It may be interesting to state as there are comparatively few upholsterers living who remember the time when springs were not used, that his impression is that he first used them about forty-five years ago. I shall take it as a great favour if any reader who is in a position to do so can give me any information on this point.

With this preamble let us start work. The materials required are precisely those that have been already described, with addition of springs. These should be "coppered," *i.e.*, the steel is coated with a thin covering of copper, which diminishes the risk of rust and consequent rotting of the adjacent upholstery. The ends also should be "coiled," as they are much better than those which are simply bound with iron. These are not only more apt to slip, but the wire has a tendency to rip the canvas. Another important point is that when the spring is compressed each coil should be well within the other.

These little matters are just mentioned for the benefit of those amateurs who have to rely on their own judgment in purchasing springs. Those who get them from any good upholstery shop may depend on having the right thing supplied them. The number of springs required for a good dining-room chair of ordinary size may be stated as five, but there is no fixed rule in regard to this any more than to many other matters in upholstery. In the neighbourhood of the "squalid streets of Bethnal Green" (Matthew Arnold's sonnet, "East London"), sometimes only one spring is judged sufficient, and so it is when the price is taken into account. For good upholstery, however, one spring per seat cannot be recom-

mended—quite the reverse, and we shall not be far out if we take five as the standard number, both as regards quantity and size; therefore, for each chair get five 5 inch springs. With regard to size it may be mentioned that springs generally—I think I may almost say invariably—are a little larger than the nominal measurement.

I have said nothing about their stiffness or strength, as so much depends on the degree of elasticity required in the seat; but with a good medium strength one cannot be far out, as the amount of elasticity in the seat can to a great extent be regulated by the way in which the springs are tied down. If a soft springy seat is wanted, of course the springs are not pulled down so far as they are when a firmer seat is required.

FIG. 37.—POSITION OF TIES FASTENING SPRINGS TO WEB.

The first operation, as before, is webbing, and in fastening this the first great difference in the mode of stuffing a seat when springs are used from the ordinary stuffing, is to be noticed. In all the seats hitherto described the web is fastened to the top of the frame, but now, in order to leave space for the springs, the web is tacked to the bottom or underside of the frame. The mode of doing this is exactly as before, using, if anything, more care to see that the web is firmly tacked to the frame and that it has been well stretched. Too much attention cannot be paid to this, as if the web is not sufficiently tight the sinking that is sure to ensue is much more objectionable than when the web is tacked to the top of the frame. It is by no means a bad plan to stretch all webbing thoroughly for some hours before using, as this reduces the risk of it giving way at all on the chair to a minimum.

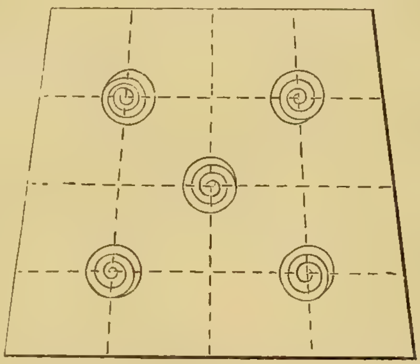


FIG. 36.—APPROXIMATE POSITION OF SPRINGS, WITH DOTTED LINES SHOWING STRINGS TYING DOWN SPRINGS.

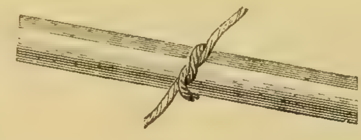


FIG. 38.—KNOT.

When the web has been fixed, the next thing is to tie the springs to it, the springs being placed as shown in Fig. 36. The exact position of each is not important, but it will be as well to see that the middle one is in the centre of the seat, and the others about midway between imaginary lines drawn through it and the back, sides, and front. To fasten them down an ordinary packing needle, which will admit of large cord or packing twine being threaded, will be the most convenient, as one strand of twine can then be used. If, however, such a needle is not handy, an ordinary upholsterer's will do fairly well with the ordinary or stitching twine, which, however, should be used double, though this is a good deal a matter of opinion, as one thread is occasionally used. The great thing is that there should be sufficient strength to hold the web and springs together. Provided this object is gained it does not matter whether one thread or more be used. The springs should be fastened tightly to the webbing, to which each should be attached by ties or stitches at three places (see Fig. 37). Starting, say, with the left-hand front spring, insert the needle through the web from the bottom, carry it over the bottom coil of the spring, close to it, and push needle down. Make a slip knot on the twine and pull tight. Push the needle up again through the web at the second point, and then down, and repeat the operations for the third point, when the first spring will be fixed firmly enough. Do not tie off the twine, but proceed to the next spring, say the other front one, then the centre, and finally the two back springs. At the last stitch tie the end securely, and before doing so see that the string is tight and holds the springs firmly to the webbing. It is best to thread the needle with a sufficient length of thread to do the lot with one piece, but if more than one is necessary it is better to tie the end as directed for the final at any spring and to start afresh; indeed, if preferred, each spring may be sewn down separately, but no benefit sufficient to compensate for the extra work is obtained by doing so, though opinions as to this differ. The springs being all attached to the webbing, must now be tied down above, and on this part of the work a good deal of the elasticity of the seat, as already referred to, depends; but this I imagine to be one of the niceties of the upholstery craft which will not be readily mastered by an amateur, though, after all, it only wants a little attention and discretion. To tie the springs down drive a tack—a $\frac{5}{8}$ inch one will do very well—into the top of the back rail of the frame opposite the centre of any spring. Under the head of the tack twist one end of a piece of laid cord and hammer the tack in to secure the twine. Take this forward to the nearest spring, and tie it round the second coil from the top, so as to bring the spring down sufficiently far.

Proceed with the string towards the front of the

spring and tie it there round the top coil. Then do the same with the front spring, tying first to the top coil and then to the second, and fasten down to the front rail of the seat with a tack, as at the back. The centre spring and other two are then fastened down exactly in the same way with strings from back to front. The centre spring may be tied either at the top or at the second coil.

It is most important that the springs when tied should be perpendicular, and, of course, of an even height; the centre one being a little raised if anything. If they are not perpendicular, on being compressed the different coils of metal will strike each other, and, instead of working noiselessly, will emit the unpleasant twanging sometimes heard in spring-stuffed chairs, which have either been carelessly made or in which the upholstery has become deranged.

In tying the springs down, it will be found that the string pulls them in a slanting direction towards the back of the chair during the process. Never mind that, as when the string is pulled over to the front rail this obliquity will be corrected.

Do not spare trouble to get the springs level. Were the springs left as now, though they could not be moved backwards or forwards, lateral play would still be possible; so as to prevent this repeat the tying-down process from side to side. The dotted lines on Fig. 36 show the course of these strings. The springs will then be susceptible merely to compression, and if they have been fixed perpendicularly no noise should be made by this or expansion as far as the ties will allow.

The knot used to tie the springs may be a simple one; but many prefer the knot known among seamen, I think, as a clew-hitch. Fig. 38 shows it, and if this is not clear enough, I may explain that it is the knot used to fasten the ratlines to the shrouds in making the rope ladders familiar to everyone who has seen a ship. From its construction it is not liable to slip, and whether I am right or wrong in calling it a clew-hitch for sailors, it may safely be called a "ratlin" good knot for upholsterers.

It is a good plan in fastening the stringings from side to side to tie not only the springs but also the strings from back to front, as an extra precaution against slipping; but let me repeat again, be careful not to pull the springs out of the perpendicular.

The springs must now be covered over with a piece of canvas, but no special instructions will be necessary about this, as the mode of procedure has already been fully described. The only difference is that springs now come between the web and the canvas, instead of the canvas being laid directly on the web, as in the other seats, for which instructions have been given. Perhaps it will be well to give a word of caution here, viz., not to pull the canvas so tight as to slacken the strings which hold the springs. The strain of these should be on the twine, not on the canvas. Stitch the canvas to the springs much in the way the web and springs were fastened to each other, only it will be better to tie a knot at each stitch.

When this has been done the stuffing may be proceeded with exactly as before, only it will be advisable to omit the wood slip at the back, and, instead, to stitch at back in the same way as the sides and front. All the remarks that have been made concerning single or double stuffing apply equally to the stuffing of seats with springs. By the way, is it requisite for me to say that the stuffing over springs ought to be of the kind described in Chapters IV. and V. of this series, and not pin-stuffing or hay roll. I may be excused for reminding you that with single stuffing use tack and blind stitches, and for double stuffing, which in the case of springs especially is the better way, use tack and top stitches. If anything, rather less stuffing material is required when springs are used, otherwise the top of the seat is apt to look puffy and unnaturally swollen. A few buttons may be used if required, but only in the way already stated, as the regular buttoned seat must form the subject of another chapter.

With spring-stuffed seats it is usual to cover in the webbing with a piece of holland or canvas, tacked to the bottom of the frame just in the same way that the canvas is usually put on over the webbing before stuffing. This keeps dust out, and is by some supposed to be of use in keeping the destructive moth from getting into the stuffing. Be this as it may, a piece of some material underneath gives the chair a finish.

(*To be continued.*)

PIANOFORTE REPAIRING AT HOME.

By J. H. MOODY.

III.—DAMPER LIFTS—SETTING OUT RAILS FOR RE-HANGING PARTS—BUTTONS TO ADJUST LENGTH OF DAMPER LIFTS—DAMPERS—LEAD LOADING—WIRE—FELT—DAMPER RAIL—PEDALS AND HOW THEIR INFLUENCE IS COMMUNICATED TO THE ACTION.

THE conclusion of my last article brought me up to the point where the re-erection of the action-frame marked the completion of one stage of the work; nothing however could be done toward replacing the hammers with their appendages until the stickers were provided with extensions in the shape of tapped wires or "damper lifts," which would enable them to reach and to operate upon the dampers.

Messrs. Hughes brought to my notice two kinds of

these wires, but I chose those which had a short tap, and I found the stickers already prepared with clothed holes evidently for their insertion. To get at the proper length which the damper lifts would require to be, I referred to my working-drawing and measured the distance between the hole in the sticker No. 58 and the damper bearing the same number; I then measured off on a wire rather less than the same length, and bent over the piece remaining (which was the plain end) to a right angle; this bent plain end was then pushed through the sticker from the left side, see Fig. 10, and cut off on the other side close up to the wood. It was scarcely necessary to measure the remainder in so strict a manner, and I simply bent the rest, making each succeeding one slightly longer than its predecessor, and thus in turn furnished each one of the stickers. I was now enabled to make considerable advance, and to satisfy an anxiety which I am not ashamed to own had more than once during the progress of the work filled me with misgiving, lest my ability should be insufficient to cope with the task of replacing and resolving into proper working order the parts that I had taken to pieces. I soon, however, had proof of the success of my venture, which reassured me as I readily re-attached the hammers, by screwing them one by one in their places upon the rail; the reglueing of levers to the places set out upon the new lever rail, also presented little difficulty, and the damper lifts were easily slipped through their respective sockets.

Whilst I am upon the subject of rehanging, I will notice a precaution which struck me as very necessary, and one that should be exercised in setting out rails, either for dampers, hammers or levers. I made myself a portable scale of twelve notes, which, for the benefit of those who desire the information, was the space of $6\frac{7}{16}$ inches, marked upon a slip of wood and divided as accurately and equally as possible, into twelve parts. In using this scale, I made my first mark on the lever rail, $\frac{1}{4}$ inch from the bass standard, and I was particularly careful to transfer no less than markings for twelve spaces, or one complete copy of the scale at one time. It was evident to me that if I preserved the spaces of $6\frac{7}{16}$ without reproach, that inaccuracies of measurement of the smaller spaces, or divisions, would be nicely confined within remediable limits that otherwise would have free licence to accumulate.

The propinquity of dampers and lifts was regulated by buttons, or small wooden cylinders, Fig. 11, screwed upon the ends of the tapped wires. These buttons were $\frac{1}{2}$ inch long, and $\frac{1}{4}$ inch in diameter or thereabouts, and I got them out of sycamore by sawing some of that wood into slips, roughly approaching but outside of $\frac{1}{4}$ inch square. I planed up these slips and dressed them with fine glass-paper to produce a neat and smooth surface, and I cut them up with facility into the shorter lengths in a saw-block, which was set with a stop measuring off the $\frac{1}{2}$ inch cut required for each button. I used the dovetail saw for this job, and the fineness of its cut left only a little roughness, which a rub upon fine glass-paper easily removed. I made preparation in each of these buttons for the tapped end of the lifts by boring a hole with a fine awl. When these buttons were all mounted upon their several tapped wires, the action began to give promise of a far different aspect to that which it presented when I first took it in hand; but the handling of it became a matter of risk: therefore, lest by any mischance its frail parts should incur damage, I placed it for the present in a safe place whilst I concerned myself over the preparation of the dampers, for I could quite well dispense with reference to it, as my scale of twelve notes gave me all the assistance in the way of measurements that I required.

I have thought it a good plan to give a full size diagram of one damper, Fig. 12, and reference to it is facilitated by lettering which I conceive to be a more convenient method than that of giving names to each part, besides saving the amateur from the maze of technicalities. These diagrams will, of course, be a guide for the making of a single damper, should the need arise, not a remote contingency, but I had to make a complete set, that one and all were to be alike as "peas in a pod;" therefore I adopted the plan of making their parts in series, thus, A and its brethren were cut from one piece of wood, which had the grain running at right angles with its length; the width and thickness of this piece of wood were as a matter of course, decided by the dimensions of A, and its length was purposely made greater than 58 of that part would consume, thus providing for a possible spoilage, and enabling me to discard all those that were not up to the mark. In order to get a piece of wood possessing the necessary qualifications, I was compelled to joint up end to end, three pieces of sycamore that I had previously squared and dressed up true. As I had no means of cramping so great a length whilst under glue, I fixed upon the bench temporarily two stops, the distance between which was a shade less than the combined length of the three pieces. I then arranged between those stops the pieces of sycamore, but no slight pressure induced them to lie comfortably within that space, and they consequently set up in the form of an arch, until sufficient weight to compel them to a level surface was applied. This is called "springing" together, and makes a perfectly close and air-tight joint, if the pressing out of glue may be taken in evidence, fulfilling that desirable invisibility

of lines of connection which I have heard aptly described as "wood and wood."

I let this jointed length remain under pressure for twenty-four hours, thereby affording it every opportunity of becoming firm; at the end of that time I was enabled to proceed with the further preparation which it had to undergo, which consisted in forming a half-round moulding upon one edge, and in beautifying that moulding by giving it a polished black surface. As I could not boast a hollow plane I was driven to make the best job I might, with smoothing plane and glass-paper—a process that entailed a greater degree of labour than would have been the case had I possessed the proper tool; yet, on the whole, the result was not one to be deplored, and the finished appearance did not suffer by the deprivation; in fact, I spared no pain to obtain the perfectly smooth surface, which is the indispensable preparation for ebonizing, and there was neither furrow nor crack to mar the feeling of satisfaction that I felt. For ebonizing I used drop black ground up in water with the admixture of a little glue; I applied two or three coats to the moulded edge, rubbing each application down with the finest glass-paper, and finished by oiling and polishing in the usual manner. The black had strayed here and there beyond limits, but all excess was removed by glass-paper.

The next item of preparation upon the length of wood for the dampers was the marking of certain lines which was more conveniently done while yet it was in its integral state; those lines were to indicate the places for the fitting of the following several parts which went to make up each complete damper: D a bent wire screwing into A on the under side; B the lead loading which pierces A from side to side; C the hinge that is attached to the chamfered edge of A. I scored the whole length of the wood with the marking gauge, to ensure these fittings being uniformly placed, and I also set it out for cutting up into as many duplicates of A as it would yield, scoring pretty deeply with an awl upon marks transferred from my portable scale.

Having gone thus far with the preparation of the length of wood, it was impracticable, while it maintained its length, to do more work upon it to facilitate the manufacture of the dampers, therefore I divided it into eight parts, each part being subdivided by markings denoting that it would yield eight of the part A. One especial reason I had for doing this, was that the dovetail saw which I intended to use in cutting the slots in readiness for the leather hinges, was but 6 inches long, and therefore incapable of cutting more than 4½ inches with precision. When I had cut the length into eight pieces, which I will call divisions, I took the precaution to number them, so that their order might be preserved and the faultless hanging of the dampers be ensured. To the same end I strove to make the slots in a continuous line by cutting steadily down upon the gauged mark upon the square edge of each division, to the depth of ⅜ inch. After cutting the slots, I made the bevel to provide for the unhindered working of the dampers; a sharp chisel was the safest tool to use for this, and I cut with a steady hand upon each piece in turn, sloping the chamfer from the gauged line upon the upper side close down to the slot upon the unpolished edge. The remainder of the work upon the dampers had to be done upon each one singly, and after the eight pieces were subdivided or cut up into small pieces. As I cut these off; they were laid side by side in the order that they occupied upon the parent length of wood, and I gave further assurance of preserving that order, or at all events, of replacing the pieces in proper sequence if an upset did occur, by numbering each piece. As a matter of course, division No. 1, was taken and treated with first, and so on each one until the whole of the eight were cut up, producing the 58 segments that I required, together with an ample surplus. I cut these segments off with the dovetail saw, and I took off each one a bare shaving with the plane, to render it pretty smooth. After I had dressed them all, I bored a hole in each one with ⅜ centre bit for the lead loading.

I have heard that lead for this purpose in cylindrical form, may be got at the music smiths, and if it be readily obtainable thus prepared, it will simply require sawing up into short pieces which may be forced into the holes already provided. But the amateur may not be able to reach the music smith's, or will probably prefer to rely to the fullest extent upon his own resources. I found that I could do the loading quite well, by pouring molten lead into each hole in sufficient quantity to fill it. The lead, however, shrank in cooling, and to prevent the ill-fitting metal from rattling in its receptacle whilst playing was going on, I gave to each loading a blow with a small-faced hammer. I ought to have used no more force than just sufficed to slightly flatten the lead, but I was unfortunate at first, and struck too heavy a blow, with the result that in one or two cases the woodwork was split. After that experience I moderated the force.

The hinge pieces, C, were made after the manner of the weighted pieces A; that is to say, a length of wood with the grain crossing it at right angles was first made and that being set out was cut up in division, slotted, chamfered and subdivided, and when the full complement of hinge pieces were cut out, I set about joining them to the weighted pieces, using hinges of leather to connect the two parts.

These hinges were cut long enough to occupy both slots to their full depth, and they were wide enough for a piece to hang out on either side of the damper; this excessive width was useful when inserting the leather into the slot, and enabled me to grasp the hinge with the thumb and finger of each hand to pull it fairly home. The leather was fitted and glued into the hinge pieces first, and when these had been in the cramps for twenty-four hours and were dry, the insertion of the remaining piece of leather into the weighted pieces was effected in a like manner; when that, too, was dry, the connection of the parts was rendered firm and complete.

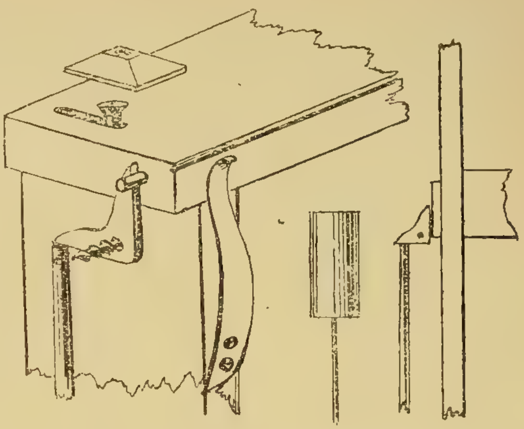


FIG. 15. FIG. 11. FIG. 16.

FIG. 15.—METHOD OF FIXING DAMPER RAIL AND WORKING PARTS CONNECTING IT WITH LOUD PEDAL. FIG. 11.—BUTTON AT TOP OF DAMPER LIFT—FULL SIZE. FIG. 16.—CONNECTION OF HAMMER RAIL WITH PEDAL.

I essayed the manufacture of the bent wires myself, and as they presented no difficulty, there is little to say, with respect to them: they were simply pieces of No. 16 tinned wire bent with the square-nose pliers, midway to a right angle, their two ends were filed to a short point, and tapped with a screw thread for about $\frac{1}{4}$ inch.

The parts, E, which actually bear the damping influence were small blocks of sycamore, sliced in series from a long piece, and were numbered from 1 to 58. Nos. 1 to 54 were faced with pads of soft felt, but Nos. 55 to 58 had simply pieces of thinner and stiffer felt inserted in slots, Fig. 13; this was to allow of their working at the treble end where the space between hammer blow and pinning was almost prohibitive of damping. When the length of wood for these small blocks was prepared, gauged and chamfered, I marked one edge to be preserved as the top, after which I cut it up into the number of pieces that were required.

The attachment of the bent wires to the small blocks was made upon the line that had been gauged for the sake of uniformity upon the length before it was cut up; therefore, I bored the holes for them upon that line, near to the left side of each block. After that I put together the parts which were comprised in each damper, the bent wires being connection between the weighted pieces A, and the small blocks E. When I had got these together, the small blocks were not directly opposite the weighted pieces, but were a little to the right side of them, see Fig. 12 (damper in elevation); the reason for this irregularity was that the damper lifts being attached to the left side of the sticker, stood up at the left side of the hammers, the weighted pieces hung directly over them, consequently some diversion was necessary in order that the felted pieces might correspond with the stringing, hence the insertion of each bent wire being, in A, near to the right side, and in E near to the left side was a necessary provision in order that the dampers might do their work.

The damper felt, with which I covered or faced the small blocks was distinguished by a softer and more open texture than hammer felt, and may cost from one shilling upwards, according to the thickness that

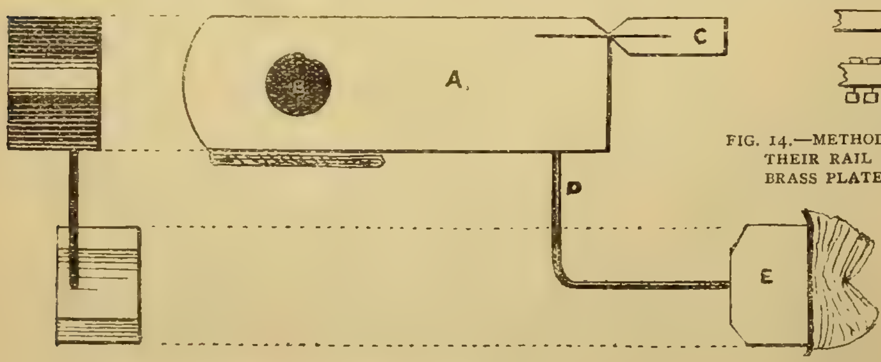


FIG. 12.—DAMPER IN ELEVATION AND SECTION—FULL SIZE.

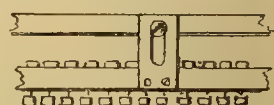


FIG. 14.—METHOD OF FIXING DAMPERS TO THEIR RAIL BY MEANS OF SLOTTED BRASS PLATE.

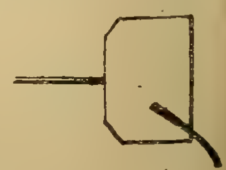


FIG. 13.—DAMPER AT TREBLE.

is chosen, I bought a medium quality to accord with the grade of the piano, which was not first class. This felt was not attached in its own surface to the wood, but was furnished with an intermediary in the shape of a red cloth backing sewn to it; this backing of red cloth, intervened to receive the adhesive medium-glue.

My method of preparing the coverings was in this wise: I first cut the felt into strips $\frac{3}{4}$ inch wide, and I cut also some red cloth into strips rather wider, I then took of each a strip, and sewed the two together with a running stitch right down the centre of their length. The cloth and felt thus united were then cut up into pieces, the same width as the small blocks of sycamore.

There was yet another piece of felt to fix upon each damper at the place where the button would touch. The glueing of these pieces completed my set, and I laid them, wires upwards, still preserving their order by placing each one in accordance with the number it bore. Meanwhile, I proceeded with the preparation of the rail, which was to carry them, and which was made of common mahogany, the same width and thickness as the standards. I made it to reach from the one standard to the other, and the method of its construction was as follows: two pieces of wood were joined together with a shorter wedge-shaped piece intervening as a riser, see Fig. 9, the longer of these two pieces was to be the actual bearer of the set of dampers, and by means of the riser it was elevated at one end to hold the dampers clear of the hammer-stroke, and it was also enabled to reach the bass standard with not too steep an inclination. The three layers of wood were glued and screwed together at the joint, to make a compact thickness, and I ran a bead plane along the top of the front edge of the longer piece. A piece of baize was glued on the under surface of the rail above the dampers, to avoid the castanet accompaniment that would intrude, were two surface of wood to strike together.

The dampers were hung primarily upon a length of pine $\frac{3}{4}$ inch square, which, after the dampers were glued upon it, was fastened to the back of the damper rail by means of three brass plates, Fig. 14, which I devised for the purpose. These brass plates were each drilled with a couple of screwholes, and were each provided with a slot, which was to aid in the adjustment of the dampers to an effective distance above the buttons.

The damper rail was now ready to occupy a place along with the

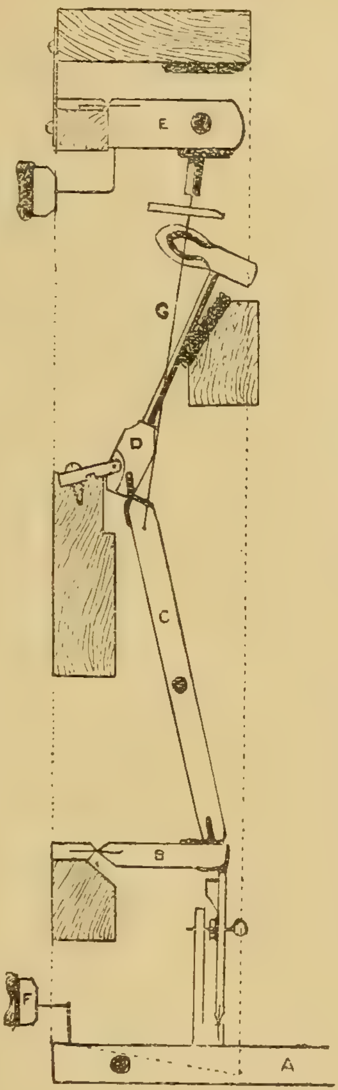


FIG. 10.—SECTION OF ACTION.
A, Key with Hopper attached; B, Lever; C, Sticker; D, Hammer; E, New Damper; F, Old Damper; G, Damper Lift inserted in Sticker.

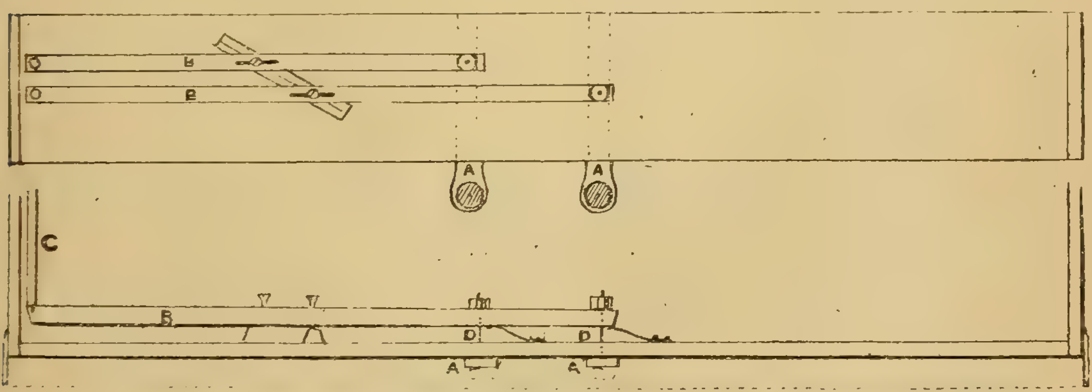


FIG. 17.—PLAN AND ELEVATION OF PEDALLING DRAWN TO SAME SCALE AS ACTION FRAME, FIG. 9, PAGE 489.

rest of the action, I therefore placed it at the top, in a position which brought each damper immediately over a button. To make the description clearer, I will say that each felted piece was in a line with its corresponding hammer. I secured the damper rail in this position by means of a couple of large screws passing through wooden caps and driven into the tops of the standards, Fig. 15; the screw at the bass end passed through a slot, the length of which limited the standing off of the rail; the rail at the treble end simply worked free upon the screw there.

Not a little thought was required in fixing the damper rail in order to get the fullest amount of work out of the dampers, to that end I noted the shape of the top bridge, which ran along the entire length of the wrest plank—for a little over a third of the distance it was directed slightly downwards, for the remainder of the space it made a more rapid descent, and meanwhile described a curve which in time brought its line of direction parallel with, and just above, the lower edge of the plank. I also noted that the line of the hammer strokes was about level with the junction of the soundboard with the wrest plank, and, consequently, at the treble end was perilously close to the pinning on the bridge. Now by working backward from No. 58, I saw that this close proximity left scarcely sufficient space for the dampers of three or four notes to do their work, hence the insertion of thinner felt. My observations also presented to me a necessity for placing the damper-rail higher at the bass end where hammer coverings were thickest, and as there was plenty of room for the hammer stroke to clear the pinning as I got farther from the treble, I adjusted the bass end of the dampers to give them a working space of ½ inch above the hammers.

The following slight alterations in the piano were occasioned by the greater length that the action-frame had acquired: First, the blocks which were glued to the key bottom for the reception of the dowels in the bottoms of the standards were moved farther apart; second, the blocks upon the sides of the piano-case, between which the action fitted, were cut away to give more space between them.

Action springs were now screwed, one upon the front of the bass standard pressing against the damper rail, and one upon the side of the treble standard pressing against the tongue of the hammer rail; these springs provided the force for the automatic return of each rail. Provision for putting the damper rail out of action, and for shifting the hammer rail from left to right, was found in "cranks," or triangular pieces of wood, fixed upon the side of the case in such a manner that they pushed each rail in response to the pulling down of the respective pedals, see Figs. 15 and 16.

When I had satisfied myself of the reliable condition of the dowels, blocks and buttons which were to hold the action in the piano, I was entitled to say that the greater part of my task was accomplished. The remainder of the work lay in the lower part of the instrument, and consisted in making and fixing the following parts of the pedal mechanism, Fig. 17: A, A, two foot levers of mahogany, each 2½ inches wide, ¾ inch thick, and long enough to reach from the back to the front of the piano, with a projection beyond the plinth of 2½ inches; B, B, two rockers of 1 inch beech, the length of each being in accordance with the distance measured from an inch beyond the centre of the respective foot-lever to the side of the case at the bass end. These rockers were attached to the foot-lever by pull-downs, and were centred upon large screws driven into a block fixed transversely across the bottom of the piano; C, two pedal rods of pine, which rested on the ends of the rockers, and worked in guides to convey the motion from the rockers up to the cranks; D, two pull-downs of stout wire, the one end of which were bent at right angles and were inserted in the foot-levers; the other ends, being tapped, passed through the rockers, and were each provided with a felt washer and an octagonal wooden nut. These were the connectors of foot-levers with rockers.

The arrangement and operation of these parts were as follows: The foot-levers were placed to protrude 2½ in. through the plinth, each one 2 in. from the centre, and were hinged underneath the piano at the farther edge; the right one was the loud pedal, and the pressure of the foot brought it down together with one end of the longer of the two rockers which was at the front, the other end of this rocker being thus tilted elevated the pedal rod which was over it, the pedal rod in turn influenced the crank, which threw the damper-rail out of operation. The left foot-lever was the soft pedal, and it was connected with the shorter rocker, which was at the back. The working of this was the same in regard to the conveyance of the pressure to the crank which shifted the hammer rail.

The two dummy pedals were firmly screwed to the bottom of the instrument, and were evidently not designed to fill any other office than an assistance to falsehood. After I had removed them, I proceeded to fix the parts for the pedals that I had made in order, as follows: Taking the rockers first, I bored holes at the ends in each one for the pull-down, and also made the ways in them for the screws, so as to admit of free oscillation. When the rockers were prepared thus, the large screws upon which they were to work

were driven through them into the block which was fixed upon the bottom of the piano and was to serve as a fulcrum. I now turned the piano upon its back to get at the lower side of the bottom, and there I bored with a 1-inch centre-bit two holes which passed right through, each one being opposite to the hole in the end of a rocker. I next hinged the foot-levers in their places, and bored holes in them to correspond with the holes in the rockers. The hole through the bottom of the piano, in both instances, was made the largest of the three, in order to provide an unobstructed passage for each pull-down. After these last were attached, the piano was replaced in the perpendicular.

I now once more turned to the interior, and screwed action springs upon the bottom of the piano to oppose the pulling-down of the rockers. Two blocks of wood, each provided with clothed sockets, were now screwed to the inside of the piano at the bass end, to serve as guides for the pedal rods. The pedal rods were tipped at either end with a felt pad, and pieces of felt were also placed in the apertures in the plinths where the pedals protruded. The application of blacklead, to assist silent working where needful, brought my task to a conclusion.

With the replacing of the action, I had the satisfaction of proving the success of my 'prentice efforts, and the approval of my friend, the owner of the piano, added not a little to the gratification I derived. Still, above all, there arose a feeling that would not be suppressed—of regret that the congenial occupation which had been the evening solace after many a day's "horrid grind" had come to an end. Then I remembered that the recital of my experiences might prove useful and helpful to many readers of AMATEUR WORK, and this, in some measure, helped me to get over the soreness I had felt in finding my pianoforte mending finished.

MODEL ENGINE-MAKING.

By J. POCOCK.

XII.—A DOUBLE-CYLINDER LAUNCH ENGINE.

THE engine I have to describe in this number is a double cylinder launch engine, made from castings supplied by Messrs. Lucas and Davis. The castings consist of thirty-two pieces as follows:—1 Bedplate, Fig. 112; 1 Top-plate, Fig. 113; 4 Standards, Fig. 114; 2 Cylinders, Fig. 115; 2 Cylinder Tops, Fig. 116; 2 Cylinder Bottoms, Fig. 117; 2 Pistons, Fig. 118; 2 Steam Chests, Fig. 119; 2 Slide Valves, Fig. 120; 2 Connecting-Rods, Fig. 121; 2 Eccentrics, Fig. 122; 2 Eccentric Bands and Rods, Fig. 123; 2 Crossheads, Fig. 124; 3 Shaft Bearings, Fig. 125; 1 Balance wheel, Fig. 126; 2 pieces, each of which forms a cylinder and steam-chest stuffing box, Fig. 127.

The cylinders are 1 inch in diameter and $1\frac{1}{2}$ inch stroke.

The steam-chests, cylinder-bottoms, and eccentrics, all have chucking tenons cast upon them for convenience in turning.

The cylinders, with their steam-chests and slide-valves, will, of course, be finished off in the same manner as in the other engines described, except that the cylinders will have to be bolted down upon the top-plate. This may be done by making screw-holes in the plate to coincide with those in the cylinder-tops and cylinder-flanges, and screwing plate and covers to the cylinders with the same screws. Three marks will be found on the top-plate, one showing the centre of the plate, and the other two indicating the position of the centre of each cylinder. Taking these two latter marks as centres, two half-inch holes must be bored in the top-plate, for the stuffing-boxes of the cylinder covers to pass through.

The standards are best bolted to the bed-plate with small bolts and nuts, using two for each standard. The positions of the standards are shown at A, Fig. 112. The top-plate is placed symmetrically upon the tops of the standards and secured in the same manner.

The crank forging is made as described in a previous article, except that in this instance there must be two crank pieces welded on to the bar, and these pieces should be at right angles to each other, as seen in Fig. 128.

I may here mention for the benefit of those who find the labour of filing a crank out of the solid forging too tedious, that Messrs. Lucas and Davis supply *bent* cranks which only require turning and finishing. The standards act as guide-bars also, and the inner side of each standard with its flanges must be filed and scraped up smooth and true.

The cross-heads must also be filed up, and a slight groove filed in each end to fit the guiding part of the standards.

The fitting of the connecting-rods to the cross-heads and cranks will present no difficulty, the cross-head and connecting-rod being held together by a $\frac{1}{8}$ inch steel pin; and the crank end of the connecting-rod being sawn across where marked, the two parts are screwed together and drilled to take the crank.

The position for the three supports for the shaft is shown at B, Fig. 112. They must of course be sawn across and drilled with a $\frac{1}{4}$ inch drill for the shaft, the latter being turned down to the same diameter at the parts which are to rest in the bearings.

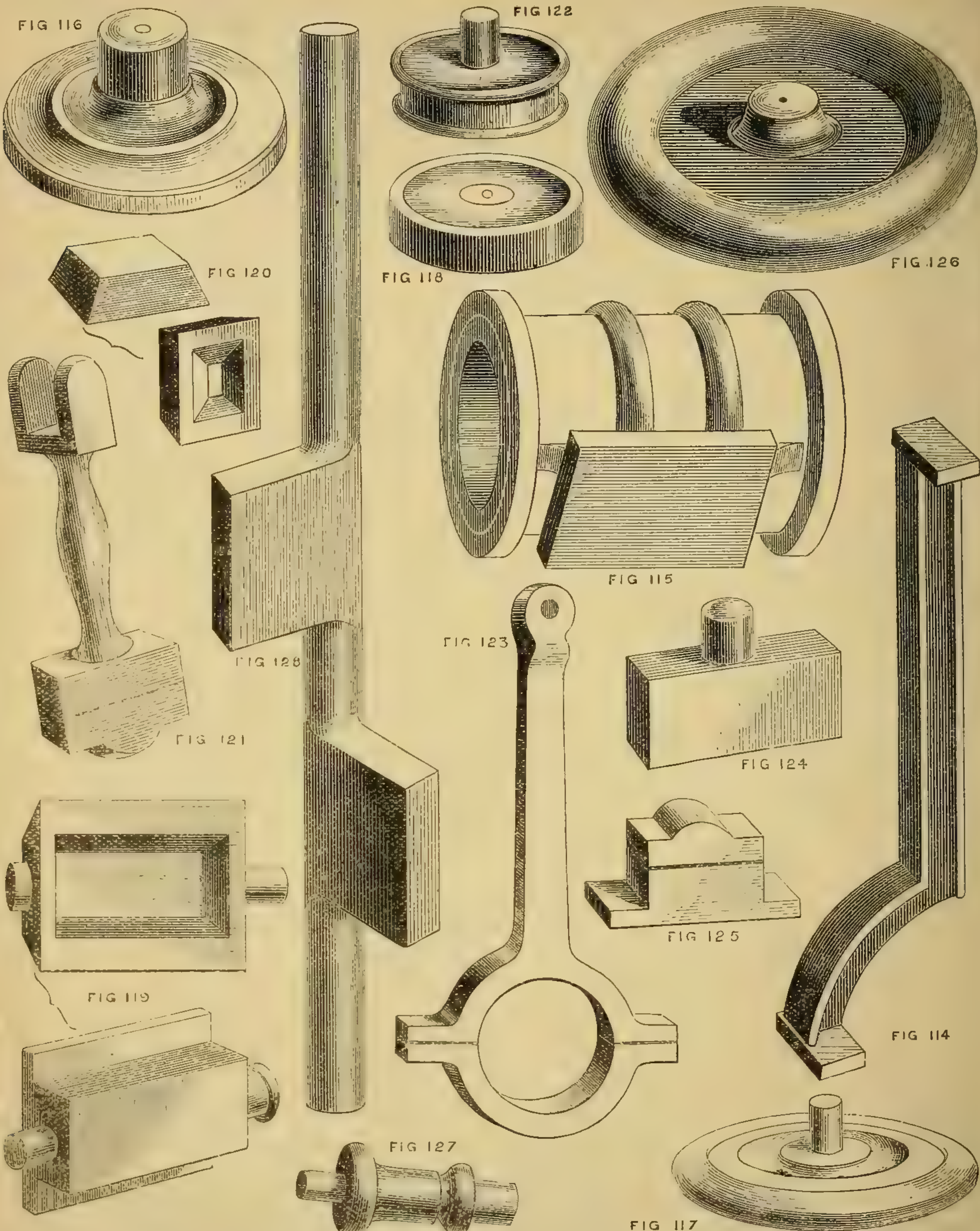


FIG. 114.—STANDARD. FIG. 115.—CYLINDER. FIG. 116.—CYLINDER TOP. FIG. 117.—CYLINDER BOTTOM. FIG. 118.—PISTON. FIG. 119.—STEAM-CHEST. FIG. 120.—SLIDE-VALVE. FIG. 121.—CONNECTING-ROD. FIG. 122.—ECCENTRIC. FIG. 123.—ECCENTRIC BAND AND ROD. FIG. 124.—CROSS-HEAD. FIG. 125.—BEARING. FIG. 126.—BALANCE WHEEL. FIG. 127.—STUFFING BOXES. FIG. 128.—CRANK FORGING.

The eccentrics and eccentric bands are to be fitted as in the other engines already described; half the band will, however, be in one piece with the eccentric-rod. In the top of the eccentric-rod, a slot must be filed to receive the head of the slide-valve rod, which latter is formed from a piece of brass rod filed flat at one end; the two parts are then put together and held by means of a small pin.

The bed-plate must, if necessary, be filed away to make room for the revolution of the eccentrics.

The balance-wheel, Fig. 126, answering to the fly-wheel of other engines, must be screwed or keyed on to the end of the shaft, and our engine will be finished.

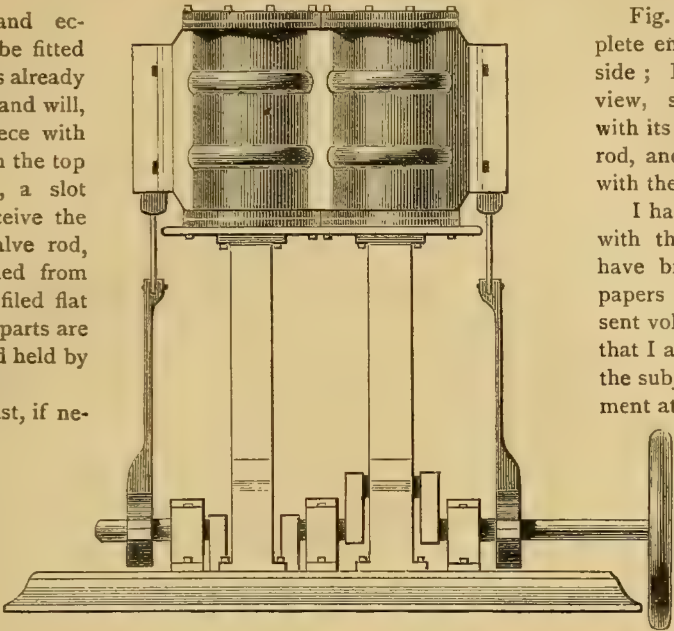


FIG. 129. SIDE VIEW OF LAUNCH ENGINE, COMPLETE.

Fig. 129 shows the complete engine as seen from one side; Fig. 130 is an end view, showing one cylinder with its guide and connecting-rod, and Fig. 131 is the same with the eccentric added.

I had hoped, in accordance with the Editor's desire, to have brought this series of papers to a close in the present volume; I find, however, that I am unable to do so, as the subject has required treatment at greater length than I originally contemplated. I must, therefore, crave the patience of readers for a short period, promising to come to a conclusion and make room at the earliest possible opportunity for other subjects for which there is a pressing demand.

(*To be continued.*)

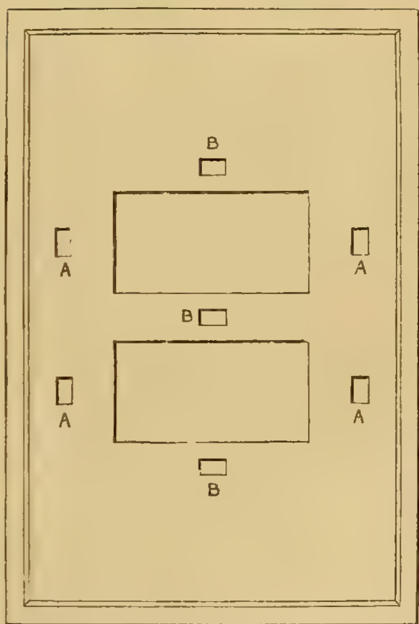


FIG. 112. FOUNDATION PLATE.

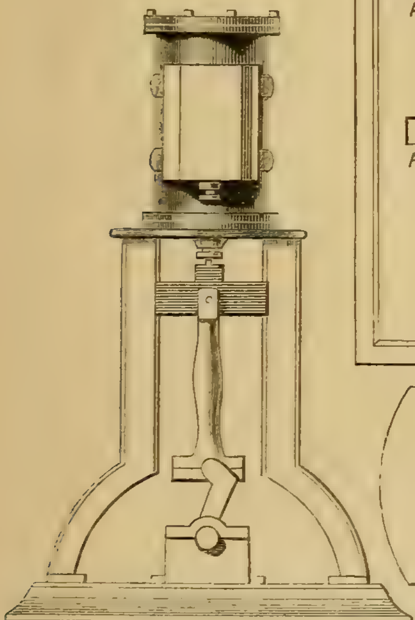


FIG. 130.—END VIEW OF LAUNCH ENGINE, COMPLETE.

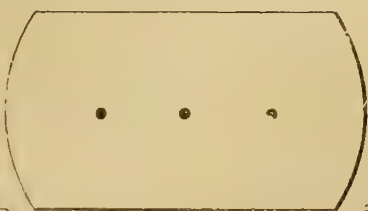


FIG. 113.—TOP PLATE.

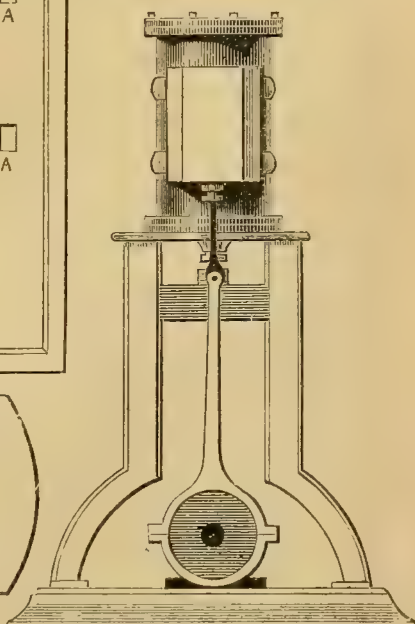


FIG. 131.—END VIEW OF LAUNCH ENGINE, COMPLETE.

PHOTOGRAPHS IN "NATURAL COLOURS."

By a PROFESSIONAL PHOTOGRAPHER.

WHO amongst us engaged in the professional studio has not, during the *mauvais quart d'heure* while the dark room assistant is busily engaged in developing the series of negatives which have just been taken of the "Divisional M.P.," who amongst us has not had to listen to the trite observation delivered with so much pomposity, with such prescient foresight, "I suppose the next thing you will be doing, will be to take the photographs in their *natural colours*." There is just a little difficulty anent the suitable reply to this platitude. It was many years since, but the echoes of that cult heard in the classic groves of Akademe have not yet ceased to vibrate upon the ear, the teaching has not yet been controverted that colour is an optical delusion; *and* the problem is how to perpetuate on paper or other material, this optical delusion by means of the salts of silver darkened, not coloured, by the agency of light.

And following a too prevalent standing of commercial morality, it might be said there is *one* way open to the perpetrator of photographs in natural colours—to think of a good title and form a public company. All that is then wanted is the modern prospectus and—the *subscriptions*. It is positively astounding, notwithstanding the beneficent blessings of our Board School education, how the British public venerate the enormous gooseberry, the sea serpent, the photograph in *natural colours*. Only advertise that the new process—it must be a new process and preferably a "patent" one—will immortalize the radiant beauty of Angelina Spifkins by rendering her in her "natural colours," with the lily whiteness of her alabastrine complexion, portrayed on paper without the assistance of material paint and brushes, hare's foot or powder; and such is human vanity, it hastens to swallow with an avidity which would delight even Dr. Tanner in an Irish debate, because those artists never do one justice, their paint always shows the brush marks.

It was only yesterday that a fond mother brought her darling to the studio for the usual portrait. It was to be coloured. The tone of the child's hair would have put a tomato to shame. "You won't forget its hair, will you, sir; it's auburn, it's not——you see, sir, it looks darker now because it has *just been cut!*" Another client, a gentleman, brought the partner of his sorrows to gaze on the style in which he was about to display the magnificence of his proportions. "There, missis, that's how I'm going to be done; ile paint for my money, there's nothing like ile paint." But had the prospectus been composed and printed, there is not the slightest doubt that both these worthies would have invested their superfluity of cash in "Natural Colour" Photographs, in the firm conviction that their complexions would come out more angelic and the hair more auburn.

There is yet another method of perpetuating the "natural colour" craze, and that is by the reading of papers at conventions. "*Experimentum periculose!*" Some happy people seem possessed of the idea that if they can but chemically stain a piece of paper to a pinky red or brown tone that an advance has been made in the "limited area of colour portraiture." In the name of all the gods, why is a more limited area to be ascribed to portraiture than to landscape photography? are not the various tints in the human face sufficiently numerous, sufficiently subtle to satisfy the most enthusiastic amateur who, before he condescended to paint a landscape, would seek a tube of every colour that ever was made in order that at the critical moment he might not be at a loss for the tint he could never mix twice alike. If pink, red, and brown are sufficient to satisfy this noble ambition, why not have recourse to the humble dye of Judson, one penny, and see you are not put off with a spurious imitation.

Before we attempt photography in "natural colours," let us attain perfection in the monochrome of the silver print. There is ample room for improvement in the composition of some pictures even though they may grace the walls of an exhibition. Landseer's "Shoeing" is a fine work of art; it does not necessarily follow that an equal degree of interest would be excited in a photograph, if in place of the horse a donkey were to be substituted. The asinine picture might not compose so well, it might even be asked why was it taken at all.

When the photographer can emulate the works of a Landseer, a Wilkie, a Gainsborough or a Linnell, when in his monochrome he can render us the expression, the tone, and the atmosphere that the great painters have given us on their canvas, then he may consider the time has arrived for him to "go into colours;" till then the various tones will but serve to accentuate too many glaring follies and inconsistencies. And the "Natural Colourist" may safely bottle up his stock of nitrate of potassium, because it is by a series of plates of each subject, one plate for every tint, that the much-desired result, the perpetuation of optical delusion, is eventually to be obtained. It is true that it is not safe for anyone, even Sir William Harcourt, to prophesy, unless one knows, but to assert that the sun will never be made to do duty as a painter in colour may be fairly hazarded.

PURE REPOUSSE WORK,

AND HOW TO DO IT.

By LANCELOT L. HASLOPE,
Author of "Repoussé Work for Amateurs."

IV.—SUITABLE DESIGNS FOR AMATEUR REPOUSSE WORKERS.

(*For Figs.* 1—10, *see the Folding Sheet issued with this Part.*)

THE group of designs which form the subject of the Supplement to this number are taken from a portfolio, specially designed by Mr. Gawthorp for the use of amateurs. They are admirable illustrations of the various classes of work, that should be put upon metal from the simplest to the most difficult, and give some idea of the variety of articles that may be decorated by this fascinating art. I strongly recommend my readers to obtain the entire portfolio, the designs it contains are very masterly, and many of them are as well adapted for carving, painting, or needlework, as they are for working on metal

I must now endeavour to describe the various methods to be employed in working each of the patterns before us. The easiest, and therefore the best design for the beginner to commence with, is Fig. 7, as the curves of the outline all flow easily and no special difficulty presents itself in any part of the drawing. The brass plate having been "sanded," or roughly polished, and the design transferred to it, I should recommend for the first attempt that the outline be secured by going over it with a steel point. As I have before said, I do not do this myself, partly on account of the extra trouble it involves, and more particularly because it is most difficult to make an even clean line on the brass, and if this be corrected when cut with the tracer the irregular scratches made with the steel point, will show on each side of the chased line and interfere with the beauty of the work. A very little care will enable my readers to dispense with the process altogether.

The plate being properly secured to the pitch with a straight tracer about $\frac{3}{16}$th of an inch wide, go over the outline, commencing with the stem and branches as being the easiest parts, and finishing with the fruit and tendrils, the ends of the latter and the calix of the fruit will be cut rather more easily with a small slightly curved tracer, though probably a professional would use a straight tracer for the whole of the work. When the outline is finished, the ground should be worked over with a suitable mat, and the work will be so far completed.

I must guard my readers against putting in the shading lines; they are only intended to give the idea of form, and must on no account be reproduced. When the workman has succeeded in producing a really good outline, and *not before*, the plate may be reversed on the block and the beating up be attempted. The pitch should be cold, or nearly so, for the first attempts. With an oval faced tool commence on the leaves, and carefully work them up on each side of the centre rib, moving the tool gently along as it is struck with the hammer, and leaving the centre rib and the outline of the leaves on the same level as the ground of the design. The tool should be used just as it would be if the material worked upon was soft, and the object was to scrape out portions of it and to leave them hollow. The tool must be kept in motion during the whole of the work, or marks will be made which will appear on the other side. This is particularly necessary in the case of the leaves which are intended to be raised smoothly and evenly, and without a great deal of modelling. This will form good practice, and should be persevered with until a perfectly smooth surface can be produced on the face side of the work, and no marks of the tool used in beating up be visible.

Many subjects, such as figure-heads, smooth fruit, etc., would be quite spoilt by the tool-markings showing on the face side; and as it is difficult even by working over the face to get them out, every care should be taken not to put them in. Just the reverse of this is the case of the branches and stem; the object here being to give them a rough and rugged appearance to resemble bark, single blows should be frequently struck and the end of the tool used in different places, so as to raise some parts higher than others; smaller tools may also be used occasionally with good effect. The fruit may now be raised after the same manner, and with the same kind of tool, using smaller sizes for the calix and sides of the fruit. The stems and branches are raised most easily with an oblong tool of suitable size, care must be taken here to keep well within the outline, so that the design may stand up sharply from the background.

The work will have a more finished appearance if the fruit, leaves, and branches are worked over with suitable texture tools, which may be done before the beating is commenced. When finished, the work may be mounted on a piece of ebonized wood cut to the shape, with a chamfer round it, a sconce being screwed into the circle at the foot of the design, or it may be made "stable lantern" fashion. To do this, leave out the circle and semicircle at the foot of the design, and cut the bottom line straight across. The brass must be left about 2½ inches longer than shown in the drawing, this piece must be turned up at right angles to the back, and a sconce fixed in the centre of it. A hole should be drilled in the upper part of the back,

to hang it up by. A suitable sconce is easily made by cutting off a piece of brass tubing $1\frac{1}{8}$ of an inch long and 1 inch diameter outside, trim this over in the lathe and make a crease round it $\frac{1}{8}$ of an inch from the end. On opposite sides mark out in this space a small piece about $\frac{1}{16}$th or rather more in width, these pieces are to form pins to hold the sconce by; now saw along the crease each way until you come to the pin. For this purpose a piercing saw is best, and with two vertical cuts each pin will be finished. Bore two holes to receive them in the brass, and with a light tap of the hammer clench them down to it. This is a much neater and stronger method than soldering the sconce on, and if a lathe having a division plate be used, the little pins may be set out with great rapidity.

I have cut this pattern just as I have described it, and it looked remarkably well when finished.

FIG. 11.—DESIGN FOR MOUNT IN FRAME FOR PHOTOGRAPH.

Fig. 1 will, I think, be the next best subject to attempt. The same tracer may be used for the bulk of this work, but for the serrated edges of the leaves a thick curved tracer is better than a straight one. The outside edge should be cut first, and the line made by the tracer should taper from the point inwards. The small indentations can be put in with a smaller curved tool. The eyes of the flowers may be knocked in at a blow with a ring tool. There is very much more scope for artistic effect in this than in the other design, and if it is carefully worked up the result ought to be very good. It should be noticed that the leaves are intended to be worked quite differently to the previous ones, considerably more modelling being introduced; not only is the centre rib of each leaf depressed, but the fibres that spring out of it on each side are kept low, this, of course, is done by beating up the space between them. One edge of each leaf is also raised by running an outline along it on the back. It is desirable to introduce as much variety as possible in the treatment of each leaf, so that they may have a natural appearance and not look as if they were all stamped out with one tool. The shading lines should again be omitted here, but the ray-like markings spring-

Fig. 3

Fig 1

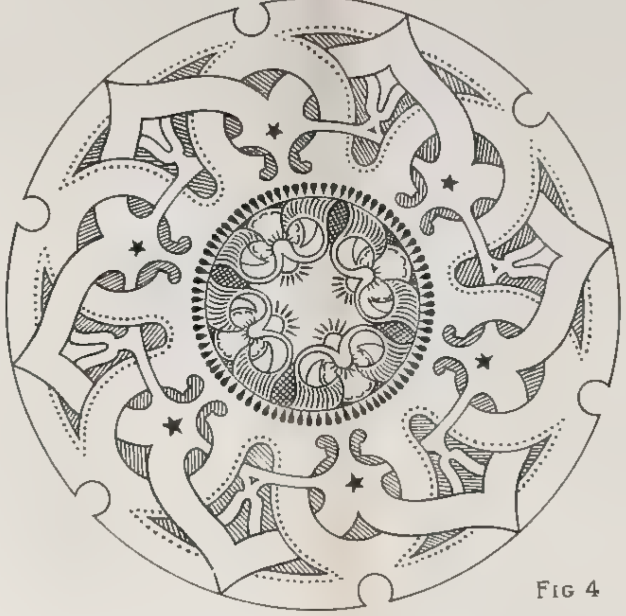


Fig 4

Fig. 1.—Design for Blotting Case Mount. Full size of Panel.

Fig. 2.—Sketch of Case.

Fig. 3.—Patera or Centre of Panel—Flowers and Foliage.

Fig. 4.—Patera or Centre of Panel—Arabesque Design.

Fig. 5.—Small Medallion.

Fig. 6.—Small Medallion.

Fig. 7.—Panel—Fruit and Foliage.

Fig. 8.—Emblematic Design for Smoker's Tray for Ashes.

Fig. 9.—Door Plate—White Lily and Leaves.

Fig. 10.—Door Plate—Flowers, Fruit, and Foliage.

Fig 10

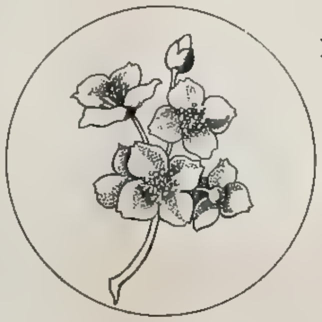


Fig 5.

DESIGNS FOR REPOUSSE WORK

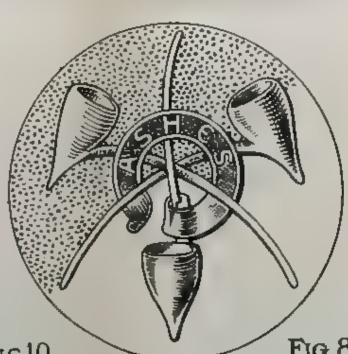


Fig. 8.

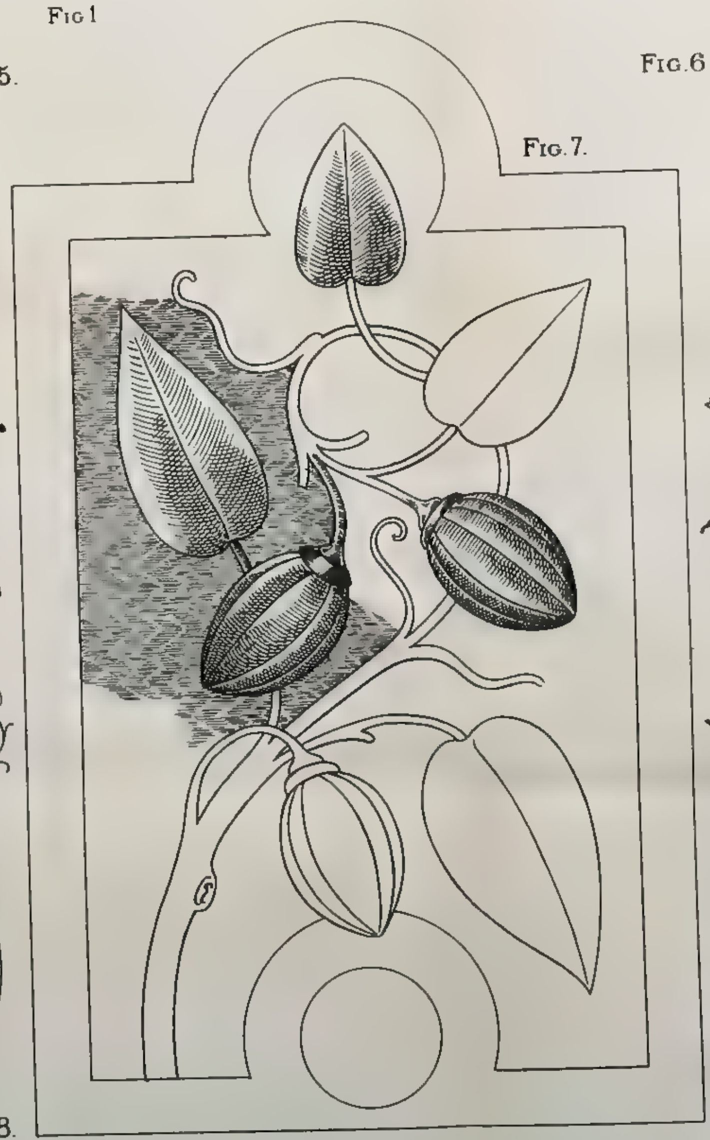


Fig. 7.

Fig. 6

FROM THE PORTFOLIO OF MR. T. J. GAWTHORP ART METAL & MEMORIAL BRASS WORKS 16 LONG ACRE LONDON. W.C.

Fig. 2

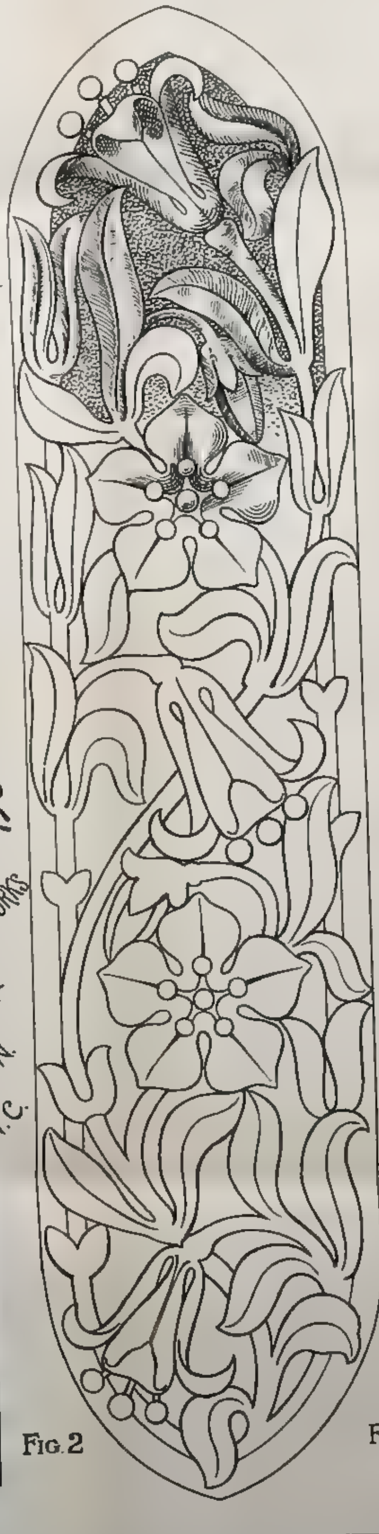


Fig 9

ing from the centre of the flowers should be put in with a sharp tracer. After the beating up from the back is finished to the best of the workman's ability, the work may be very much improved by laying it down face upwards, and modelling it afresh from this side, beating down the ground where it has become raised, and generally improving the whole effect. I must, however, again warn my readers not to attempt too much at once, as it is very desirable they should perfect themselves in plain chasing, and beating up before they attempt the more difficult art of working on the face. At the same time, this strikes me as a particularly good pattern to commence upon. The centre medallion should be evenly raised all over; if any lettering is to be put upon it, it is better to do this with the graver than the chasing tool.

Fig. 2 shows the method of mounting the design as a blotting book; there is no difficulty in the amateur doing this for himself if he feels so disposed. All that is required is to cut two pieces of strawboard to the required size, and cover the edges with morocco leather: the back is also made of the same leather. The inside is covered with ornamental paper, paste being used for this part of the work. Two pieces of fancy wood (I always use walnut) about $\frac{3}{16}$ inch thick, must be glued on to the outside so as to let the leathered edge show for about $\frac{1}{8}$ inch all round, this makes a nice finish. The brass can either be attached to the board by ball-headed screws, or be let into a rebate from the back. The best wood to use for this purpose is that which is sold for fret cutting, as it is already planed, and being dry is not liable to warp. Of course, after the boards are attached, the book must be carefully pressed until quite dry.

FIG. 12.—DESIGN FOR SCONCE BACK—HALF SIZE.

Figs. 3 and 4 are two very charming designs for flat chasing. Here we have much more difficult outlines to deal with than those we have been treating

of, and it will require much practice before they can be cut perfectly; where, as in this case, a portion of the design is repeated again and again, any irregularity is all the more easily noticed. I have not cut either of them, but I should consider Fig. 3 the more difficult one of the two. Curved tracers of different degrees of curvature will be of great service here; they will also be required of different sizes. Special care will have to be taken in transferring this design; without an accurate outline on the brass to commence with, there is not much hope of the amateur making a good job of his work. A very fine mat, such for instance, as is made with the freezing tool, will be the most suitable for the centre of this design.

Fig. 4 can be worked with the same tools and in the same way as Fig. 3, and being the easier pattern of the two had better be attempted first. The black oval markings round the centre of the design should be made with one blow of the tool, a special one being of course required. It is a very easy shape to make, all that is required is to flatten the end of a "brindle" and file the sides to the shape. The black stars should also be made with a star-shaped tool formed out of a piece of round steel, the spaces between the points of the star being filed out with a small three-square file. It is well worth while to have one of these tools as it comes in for open matting and a variety of other purposes. In grounding this pattern, I would suggest that three different mats be used—one for the centre circle, another for the circular openings around the stars, and a third for the rest of the pattern, this will give character and variety to the design. Figs. 3 and 4 are very suitable for the centres of waiters, with or without another pattern round them.

Figs. 5 and 6 require no special description; they are adapted either for flat chasing or repoussé work, and will be worked most easily with small tools; they are intended for decorating small trays for cigar ashes, etc.; they can also be made into very charming pincushions for the drawing-room, by drilling fine holes round the edge and sewing them on to a circular pad made of plush and stuffed with wool. They should be finished with a large bow of ribbon on the top. Fig. 8 is an ash tray; excepting the lettering the pattern is not a difficult one to work. To give full effect to it it should be beaten up, though it would look very well in flat chasing.

The handsome patterns, Figs. 9 and 10, are intended for finger-plates for doors. The chasing, though requiring a good deal of skill is yet not extremely difficult, but the beating up will require long practice before it can be done perfectly. Some of the curls of the leaves are so very sharp that great care will have to be taken in modelling them, and it will be hardly possible to work them as they should be, unless they are finished on the face after being beaten up from the back. The small circles that occur in Fig. 9 will have to be struck with a ring tool and beaten up with a ball tool of corresponding size. All shading lines must again be omitted here. Both of these patterns would look extremely well if pierced, the ground being cut out with a piercing saw, or, still better, with a fret-cutting machine. If it be decided to work them in this way, care must be taken that no loose parts are left, and that the outlines touch one another so as to give sufficient support, and not render them liable to be caught by the housemaid's duster. The work should be entirely finished before the piercing is commenced. It is better to bore the holes for entering the saw a little way from the outline, and not immediately on it, and when two lines meet at an acute angle, the saw should be worked along each of them separately, so as to meet at the apex of the angle. The effect will be much better if worked this way than it would be if the saw was turned at the junction of the two lines.

Fig. 11 is intended for a photograph frame, and requires but little explanation. I think it would be worked rather more easily and keep its shape better if the centre piece was removed before it was worked. A rebate made of metal, will have to be soldered on to the back to hold the photograph after it has been finished. This is an excellent pattern for carving in wood, and by no means difficult to work in metal.

No. 12 is one of a series for which Mr. Gawthorp received the first prize silver medal at the Royal Cornwall Polytechnic Society's Exhibition last year. It was most beautifully worked, every part being tooled over on the face, and the texture of the leaves, feathers, etc., admirably rendered; the background was left bright and not matted. It is intended for a sconce back, the sconce to be fixed in the circle at the lower part of the drawing. It is drawn here half-size, but lines as aids to enlargement are given. It would do extremely well without enlarging, for the centre of a blotting portfolio, or for a small oval tray. The lines on the leaves are to be put in with a sharp tracer, and the edges of the leaves well raised, indeed all over there is abundant room for the modeller's skill.

In the foregoing pages I have endeavoured to give a clear and distinct description of chasing and repoussé work as far at least as it can be taught by verbal description; but my readers will find that they will acquire a knowledge of the art much more rapidly if they have at least one lesson in each of the three different processes. When in doubt myself as to the best method of treating some subject with which I was not familiar, I have had a small piece of the work done for me, as an illustration, by a professional, and I have derived the greatest benefit from this

course. I have by me quite a collection of patterns, which have accumulated from time to time, and which I keep at hand to refer to as I may require.

In my next Chapter, I shall hope to give designs for several small articles such as an amateur of average skill would be able to make for himself, and which he could afterwards decorate by the processes I have described.

(*To be continued.*)

WOOD-CARVING IN IRISH BOG OAK.

By ALEXANDER WATT.

V.—Carving in Relief (*continued*) — Ornamental Carving on the Box—Drawing the Design—Bog Oak Paper-Knife—Designs for the Handle —Carving Leaves—Bog Oak Crosses.

CARVING IN RELIEF (*continued*).—The plain box described in the last paper being now ready to receive the ornamental design to be carved thereon, I would recommend the operator, after having decided upon the pattern he intends to carry out, to begin upon the top or lid of the box, first drawing a margin of about one-eighth inch all round, and then tracing the outline of the design neatly and artistically; he should then examine his drawing to see that it is without any serious fault. Being satisfied upon this point, he should next cut through all the pencil marks with the graver, to preserve the outlines from obliteration when handling the box in the process of carving. Subject to the carver's own choice in the matter, I will suggest a design which will not only be tolerably easy to execute, but is also suitable for this class of work. In the centre of the lid a shield may be drawn for the initials of the owner—say, of the form shown in Fig. 20, for example —and the surrounding surface within the margin may be filled in with shamrocks neatly grouped, with their stems springing from an imaginary ground near what will be the front of the box when it is finished. The stems should be traced with a bold outline to allow for necessary thickness. As to the size of the shamrock leaves, this may, to some extent, be left to the will or taste of the carver; but, probably, he will find those represented in Fig. 21, which is suggested as a design for the front of the box, a convenient size for such a purpose.

Carving the Box Lid.—The marginal line round the face of the lid should be boldly cut with the graver, taking great care to leave the margin exactly of the same width all round. The next thing we have to do is to reduce all parts of the wood outside the various figures of the design to the depth of about one-sixteenth of an inch, so as to leave the shield, shamrock leaves, and stems in relief. The clearing away of the wood must be done with great care, so as to avoid cutting away portions of leaf stalks, outer edges of leaves, or in any way intrenching upon the outline of the figures. To remove the wood from the ground of the design, the $\frac{1}{4}$ inch chisel, dog-legged tool, and a small gouge may be used, as also a small scorper for certain parts. In using the chisel, it should only be allowed to pass up to, but not beyond, the engraved outlines, whereby a trifling space will be left around each figure (leaf, stem, etc.), to be finally removed when all the rest of the wood is cleared away. If this precaution is carefully observed, the preservation of the outline of each object, upon which the whole beauty of the work will mainly depend, will be a matter of no difficulty. When the ground has been cleared away to the required depth, the work should be well examined, and such parts as may still require deepening a little farther should be then attended to and properly reduced. Since this part of the work is to be rendered rough, or *matted*, as I shall presently explain, there will be no necessity to make any attempt to render it smooth with the chisel, etc., when clearing out the surplus wood from this surface.

It will now be necessary to work all round the shamrock leaves and stems, and also the shield, with the small chisel, to remove what little wood remains outside the true outline of the pattern, so as to leave each figure perfect in form. Having done this and well examined the work for defects, if any such appear they must be remedied before proceeding further. The forming of the shamrock leaves will be our next consideration. Each leaflet, on either side of its dividing line, must be cut downward up to the line, until a V-shaped cavity or groove is formed, as directed in reference to the shamrock stud, care being observed to make each side equal. All the shamrock leaves will then have to be treated in the same way and all inequalities touched up. The wood on either side of the leaf stalk must now be removed. The leaves must next be veined, employing the same tools as formerly for this purpose, and taking care to produce perfectly clear straight cuts or veins, upon which much of the character of the work will depend. When this is done, the division of each leaflet must be made by a clean cut with the graver, all these lines or cuts meeting exactly at one point in the centre. The stems may next be put into form by aid of the small chisel, giving each stalk a slight bevel on each side; that part of each stem which joins the leaf must be cut a little downward—that is, to the depth of the leaflet to which it points. When all the stems have been properly formed in this way, the shield may be looked to, to see that its outline is perfect. This being the case, we may next proceed to prepare

the ground—that is, to make it look rough or rugged, in contrast to the raised portions of the design. To produce the rough surface referred to, many plans may be adopted, but a very pleasing surface may be produced by means of the little beading tool before spoken of. This tool is to be heated in a candle flame, and repeatedly pressed upon the ground, or sunk part of the work, all over the entire surface. This will take a little time, and will require some patience —a quality invaluable to a bog oak carver! but if pursued with care and perseverance will meet its reward in the pleasing result that will be obtained.

The upper surface of the lid being now finished, we will next turn our attention to the front of the box, a design for which, as I have said, is seen in Fig. 21. In treating this part of the work, it is proposed to carry the design over the entire surface of both box and lid, for which purpose it will be necessary first to place the lid on the box, and in order to keep the lid from slipping off while the drawing and carving are being executed, it will be well to secure it firmly in its place by means of a bandage; a long strip of unbleached calico, about two inches wide, will answer the purpose well, if this be wrapped tightly round the closed box, from end to end, and the loose end of the bandage may be fastened by means of a needle and thread. The bandage, while securing the box and lid in their proper position, will leave the front and back exposed, so that these two portions may receive their due amount of ornamentation in succession. When these parts are finished the band may be removed and wound round the box from front to back, as before, to enable the operator to work upon the two ends. Should the carver desire to carry out the design given for the front of the box, the same design, with a margin as shown, but minus the harp, will do for the back and ends of the box. By this arrangement the front, with its harp, will be readily distinguishable at all times, and enable the lid to be put in its proper position, when closing the box, without difficulty. It is unnecessary to say that the ornamentation of the front, back and ends of the box, is to be treated in precisely the same way as directed for the top of the lid. With respect to the harp, the instructions given for making the harp brooch, will guide the operator; the strings may be formed with a thin flat scorper. After drawing the strings with a pencil, pass the scorper between each pencil line, clearing away the wood to the depth of the ground—that is, to the depth of about $\frac{1}{16}$th of an inch. When all the carving is completed, the various plain margins many be rendered bright—so as to contrast with the carved portions of the work—by means of the burnisher. The box may now be stained and polished, as before directed, when it will be ready for lining. The lining may be of purple, or other coloured velvet, fixed into its position inside the body of the box and lid by means of a little thickish glue.

Bog Oak Paper-Knife.—A very useful and pretty article, in the shape of a paper-knife, may be made from bog oak as follows:—A piece of sound bog oak must be selected, and from this a strip cut about 9 inches long, $\frac{3}{4}$ inch wide, and about $\frac{1}{2}$ inch thick. The handle of the knife may be about 3 inches long, which will leave 6 inches of wood for the blade. Now mark, in pencil, the boundary of the handle, at each angle of the strip of wood, and cut through the pencil marks with a graver. To reduce the timber to form the blade, the $\frac{1}{2}$ inch chisel and a rasp may be used at first, and when the wood becomes nearly as thin as required, the actual degree of thinness may be obtained with a keen half-round file. In forming the blade, it is convenient to make it double-edged, so that either edge may be used, without shifting the handle, and the point of the blade may taper a little, like a dagger; otherwise it may be simply rounded off, as in an ordinary table knife. The blade may now be smoothed with glass-paper, and burnished. To form the handle into shape, it must first be rendered smooth on all its surfaces, and at its ends, by filing, and then finishing with glass-paper. All the sharp edges should now be filed down, and smoothed with fine glass-paper, leaving a neat and uniform bevel at each angle, but the bevelled surfaces should not exceed $\frac{1}{16}$th of an inch in width. In the ornamentation of the handle, the carver will probably exercise his own taste, but I will suggest that a wreath of small shamrocks, cut in relief, as shown in Fig. 22, would look very well.

If this design be adopted, or such modification as may better please the operator's taste, it will be necessary to leave a margin of about $\frac{1}{32}$ of an inch all round, *within* the bevelled surfaces, to form, as it were, a kind of frame-work round the wreath, which, when completed, will be in relief. Having drawn in pencil the marginal lines, the design may next be drawn, and afterwards all the pencil marks traced with the graver as usual. We then proceed to cut away the wood surrounding each figure of the design, as before, taking care not to cut into the margin, nor to approach too close to the outline of the leaves, etc., at first, but leaving the finishing off of these portions of the pattern until the ground is sufficiently deep, that is about $\frac{1}{16}$ of an inch. When this part of the work is finished, the shamrock leaves and stems must be neatly trimmed with the chisel, and the end of each stem, where it joins the leaf, duly formed, by cutting away the surplus wood on each side. The leaves are next to be formed as before directed, and then veined, but since the shamrock leaves in the present design

are rather too small to be conveniently veined with the tools ordinarily used for this purpose, the veining may be done with the graver, but each line thus made must be perfectly straight, and all as nearly as possible equidistant. When the veining is finished, the divisional line of each leaflet is to be formed with the graver as usual. The ends of the stems at the junction of each leaf will now have to be cut down to the level of the opposite leaflet, and the stems, from end to end, bevelled off on each side to give the effect of roundness.

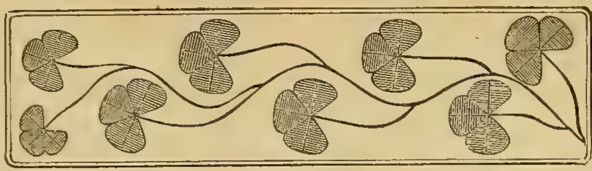


FIG. 22.—DESIGN FOR HANDLE OF PAPER-KNIFE.

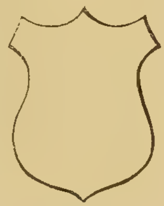


FIG. 20.—SHIELD FOR MONOGRAM, INITIALS, ETC.

To give a pleasing variety to the handle of the paper-knife, the opposite side may be embellished by the introduction of acorns, interspersed with shamrock leaves, and the addition of one or two oak leaves will improve the effect. A modification of this kind is shown in Fig. 23. In forming the acorns, after the preliminary clearing away of the surrounding timber, the outer edge of each acorn should first be neatly trimmed with the chisel, to render its form perfect; the two parts, representing the conical fruit, and the cup which supports it, must now be slightly rounded off, and the former cut down a little, so as to cause the cup to project a little. The cone may next be finished off by scraping it with the keen edge of the small chisel, keeping it neatly rounded, and this part may then be burnished. When the cup has been properly rounded off, a few cross cuts with the graver may be made to give the characteristic contrast to the bright surface of the cone which it supports. To make the acorn stems contrast with those of the shamrock, they should be scratched, longitudinally, with the end of a file; indeed, it will be all the better if the acorn cups are rendered rough in the same way, before cross-cutting with the graver. When all the carving is finished, the margins and bevelled surfaces should be brightened with the burnisher, and the entire article may then be stained and polished. As soon as the wood becomes thoroughly dry after staining, the blade and all plain surfaces may be gone over again with the burnisher to give a final touch.

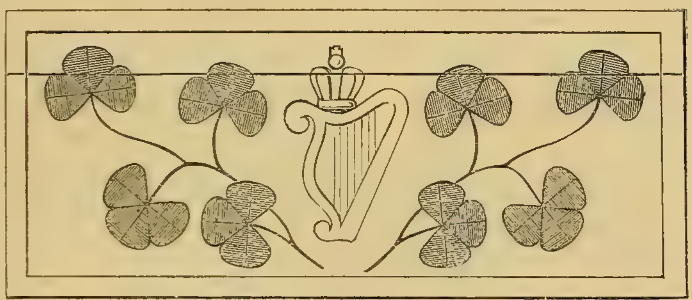


FIG. 21.—DESIGN FOR FRONT OF BOX.

Carving Leaves.—Groups of leaves, other than the shamrock, also look exceedingly well when neatly carved in bog oak, the leaves of the oak, vine, fig and bay being specially pleasing objects for the ornamentation of flat, or even rounded, surfaces; and the tools which we have already mentioned, with one or two gouges, will be all that will be required for this class of work. When such ornamentation in relief is to be applied to larger objects than those hitherto considered, it will be necessary to cut the ground work deeper in proportion, in order to admit of the proper turning of the leaves at certain points, but more especially at their apices, so as to modify the flatness which would otherwise be inevitable. Besides this, when there is a good depth of ground beneath the leaves, it will enable the carver to hollow out such leaves as may most require it sufficiently to make each leaf appear as natural as possible.

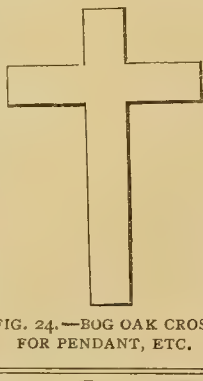


FIG. 24.—BOG OAK CROSS FOR PENDANT, ETC.

Bog Oak Crosses.—It is scarcely necessary to say that the cross, either as a pendant to a necklace, as a "charm," or to be worn as a brooch, is a very popular appendage with the ladies of the Sister Isle. The plain cross requires more careful treatment than the simplicity of its form would indicate; in the first place, all parts of the cross must be absolutely true; the front and back should exactly correspond; the various surfaces must be

FIG. 23.—DESIGN FOR HANDLE OF PAPER-KNIFE.

perfectly flat; and, finally, the whole surface should be smooth, and nearly as bright as a jet ornament of the same form. Having selected a small, but sound piece of good black bog oak, absolutely free from defects, a flat slice of the timber, rather more than a quarter of an inch thick, 2 inches wide and 3 inches long, must be carefully cut with a tenon saw. Both sides of the slice of wood should now be rubbed upon a sheet of coarse glass-paper, to erase the saw marks; it is now ready to receive the design, which must be accurately drawn in pencil. The accompanying sketch, Fig. 24, illustrates the proportions; and is just one half the size of the cross now under consideration. The outline being drawn, the surplus timber in all directions must be cleared away with the tenon saw, but in doing so much caution must be exercised in the handling of the tool, so that each cut should be made perfectly level and straight from front to back.

(*To be continued.*)

ELIZABETHAN FURNITURE:
WITH PRACTICAL HINTS ON ITS CONSTRUCTION.

By Rev. ALGERNON THOROLD, M.A.

VII.—Examples of Old Carved Chests—Dates on Chest—Adaption of Old Chests for Various Purposes—Flower Stand—Sarcophagus—Insects in Chests—Lining for Chests—Hinges, Locks, etc.—Buffet or Canterbury—Hints on Transformation of Old Chests.

IT is now some years since I first began my searches after old oak. I was then living in the country, and had opportunities of seeing and sometimes of obtaining genuine pieces of considerable value; but even at that time, as I soon discovered, I was somewhat behind the times, for the "gentleman from London" had already been round, asking for and buying not only the best of the oak, but the old china and prints. I found the remains, however—old corner cupboards, old dressers, old carved boxes, stools, chests, tables, one here and one there, and I was soon known for some distance round as a purchaser of "old things." The would-be sellers, however, did not always understand the sort of old things that took my fancy, and amongst the oddities which were sometimes offered to my notice I remember a wonderful great mahogany cradle on legs and rockers, "large enough, sir, for twins if so be you should ever want such a cradle, and real mahogany!" Books, trunks, hand-bells, crockery, oil paintings and frames for the same, cases of butterflies, dogs, cats, canaries, squirrels, and many other eligible possessions, have passed under my eye as a buyer of old oak; indeed, I found my pursuit somewhat a dangerous one, though now I have learnt carefulness through past experiences.

Two centuries and more ago the chief furniture of the Hall or Place was always made of oak, and in many cases the fine old specimens upon which now-a-days the lover of "old things" comes in his search, are the very pieces which once adorned the houses of the better families of the district. Fashion and change, however, touched everything alike, and the time came when the dark and heavy oak was considered as old-fashioned and ugly as the horse-hair and mahogany of a now bygone generation is considered to-day. And then the clearance began, and when Sheraton's and Chippendale's work took the place of Tudor and Jacobean furniture, the old oak was dismissed to make way for the new-fashioned and lighter pieces. Much of it was probably given as the marriage portion of the serving man or maid, and became the prized remembrance of their old masters in the farm and cottage. It is these that we now come across in out of the way places, heirlooms from mother to daughter, for it is to the wives of the family that we find they usually belong. But besides these better specimens which are every day getting more difficult to obtain, an inferior type of the same class of furniture was in general use. Enquiry in various parts of England leads me to believe that every woman at her marriage brought her "chest" to her husband's house in contribution to the general furniture; the size of the chest, the quality of the workmanship, the intricacy and beauty of the carving or "cutting," as it was termed, being dependent upon the position of the bride's parents and their ability to provide what might be either costly or cheap.

Some of these chests evidently belonged to the very poorest, being made of rough unplaned slabs nailed together in the most primitive fashion. In a grade higher we find the front panelled, and the stiles relieved with a coarse moulding, the sides, however, still being cut out of single boards. Others of rather a better class are found with sides and front in framed work, with also somewhat roughly executed carving on the panels.

After these examples there is a decided step upwards, and we come again, so to speak, from the cottage to the Hall. The work is good throughout: elaborate mouldings lighten the rails and stiles, or sometimes inlaid work takes its place. Upon the lid also we find much work has been expended, the solid and heavy slab being exchanged for framing and panelling, well covered with intricate designs, carved in an artistic and finished manner. Some of the

finest specimens are those which had originally been made for ecclesiastical purposes, though by the chance and change of troublous times they afterwards found their way into private hands and were put to secular uses.

Mr. Parker, of Oxford, in his "Glossary of Terms of Architecture," gives some interesting details of old chests. He tells us there that "the oldest chests known to exist are of early English date, as at Climping church, Sussex, and Stoke d'Abernon, Surrey. There are also others nearly or quite as old at Graveney and Saltwood, in Kent. The latter of these is very highly enriched on the front with panels, tracery, and carving, and is by far the most ornamental of any of this date. There is a peculiarity in the construction of early English chests which is remarkable. Across each end of the lid, on the under side of it, a strong piece of wood is fixed, which appears on the outside when the chest is closed, and the end of this and the upright piece at the back angle of the chest are halved together, and an iron pin is put through them so as to form a hinge, of which there appears commonly to have been no other. There is often a small pear-shaped piece of iron nailed over the end of the pin to keep it in its place. The carving and ornaments on chests of this date are not in general deeply cut; many of them are richly ornamented with iron work, similar to that on doors of the same period, as the Cope chests at York, at Lockinge, Berkshire, and Church Brampton, Northamptonshire.

"Of Decorated chests there are many examples, as in the churches at Branspeth, Durham; Hacconby, Lincolnshire, etc., etc. They are usually highly ornamented with panelling and carving, which both in this and the preceding style are commonly confined to the front; but at Huttoft, in Lincolnshire, is a fine Decorated chest with all the four sides panelled, those on the front being richer than the others.

"Perpendicular chests are also found in various places . . . . Oxford Chapter House, St. Mary's, Cambridge, etc., they in general differ but little from those of the Decorated style, except in the character of their ornaments. . . . . Some of the old chests found in this country are evidently of foreign workmanship, and Flanders chests are frequently mentioned in ancient documents. There is a fine example of this kind in the church at Guestling in Sussex, which has the front and ends very richly panelled.

"As Gothic architecture lost its purity, chests gradually degenerated into the plain boxes, which are now placed in our churches to receive our registers . . . . many of the later chests had the lids carved at the top like a trunk, by which name also they seem occasionally to have been called."

The same authority also points out that chests were not unfrequently called "arks," and gives some curious quotations from old works, in which this term appears.* Nothing perhaps can better carry us back into the past of the country side than the sight of one of these old oak chests, when discovered in some out of the way district, unvisited as yet by "the gentleman from London." We feel as we lift the lid, beneath which the little inner covered box, is still intact, where, perhaps, the bride who first owned the chest kept her personal ornaments and now the "good man" stores his marriage lines, that we are looking upon the survival of a long ago time, and we readily accept the date cut in the sprawling figures, of the ancient village carpenter, in proof of the genuineness of the relic.

If you are in search of chests, buy them if you can "*in loco penatium*." After all, an ordinary old chest is not a very valuable thing, but good carving and a date makes it worth much more, and the "gentleman from London" has found this out. While negociating upon one occasion for the transfer of an old dresser, the good cottager upon the selling side of the bargain, volubly instructed me upon the magic of a date on such pieces. Fortunately, perhaps, her tumble-down dresser was lacking in this adjunct, or after her story I might have left it, in doubt of mind.

A friend of her own, she said, owned a large old oak chest which excited the eyes of a chance visitor. The chest was of no particular value to its then owner, while the money offered in exchange was tempting, and after sundry bargainings, a sovereign carried the day. The purchaser carried it away, but not long, after was seen wandering round the village church. "Yes," said the good woman, "he went to that churchyard, to find a date to cut upon the chest he had bought, and I am told that when he got back he sold it for £10."

It is rarely that so much trouble is taken in the selection of a convenient date, by dealers who frequently endeavour to increase the value of their goods by such an addition. And it is well to be very careful before you buy old oak from persons who without scruple or difficulty may have inserted apocryphal figures.

There are few pieces of old oak which lend themselves so pliably, to the genius of their possessors as fairly good chests. They adapt themselves in the most satisfactory manner to an almost endless variety of devices, do what you will with them, still they eventually come in for a good purpose. One of the finest specimens I have ever seen was found filling

* *Arca* is the Latin term for a chest or coffer, thus, in this sense, "ark" is simply the Anglicised form of the word that would, as a matter of course, be used to express a chest by monkish and mediæval writers who wrote in Latin.—ED.

the humble position of corn bin, at a wayside inn in Devonshire; but now it is the beau ideal of its kind, and stands in the rooms of a college Don.

It is hardly too much to say that with a number of chests at our disposal, we may supply ourselves with all the smaller pieces of furniture with which our rooms are adorned.

Fig. 56 shows a small chest so altered as to form a flower stand. Such an one as here drawn is intended to occupy the window, and as will be seen is raised on a high stand, but that it may be equally useful, if required, for a position in which height is not admissible, the stand is a separate structure, thus allowing the upper part to be removed as desired, and stood on its own short legs, or, if preferred, on an alternative and lower stand made on purpose. It will be seen at once that no definite measurements can be given, since every chest will differ more or less from all others, the general structure only can therefore be treated.

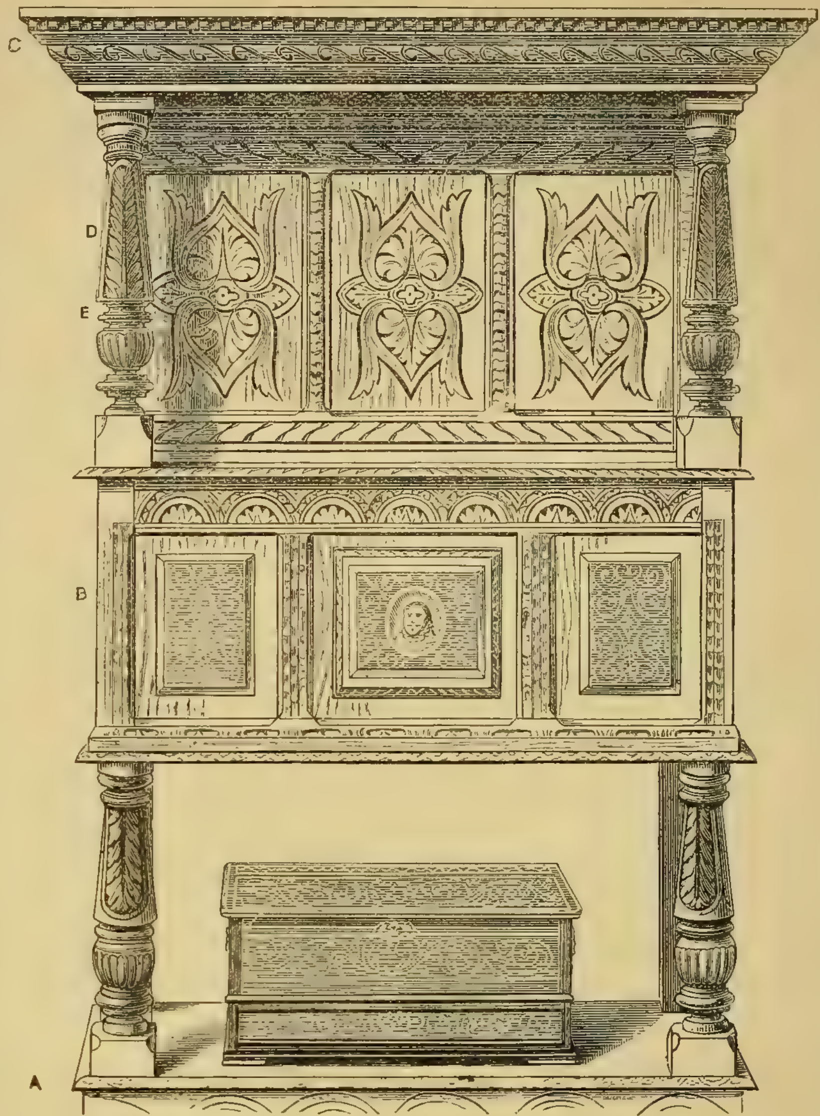


FIG. 65.—EFFECTIVE BUFFET OF CARVED OAK WITH OAK CHEST BELOW.

FIG. 59.—INNER PERPENDICULAR RAIL CUT TO ADMIT CASE IN FLOWER STAND.

FIG. 60.—PARTITIONS FOR RACK.

FIG. 64. — DESIGNS FOR ESCUTCHEONS.

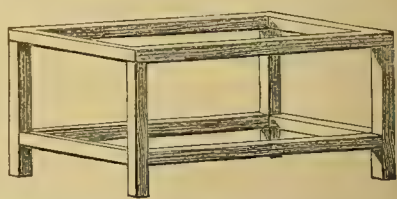


FIG. 57.—ALTERNATIVE FORM OF SUPPORT FOR CHEST.

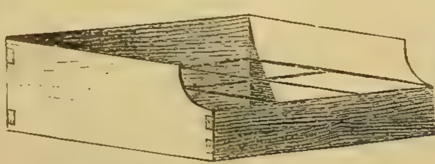


FIG. 61.—ZINC RACK AND TRAY FOR CHEST.

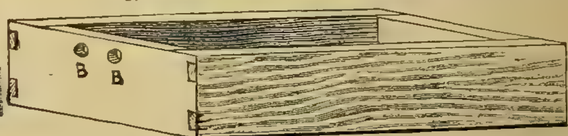


FIG. 58.—INNER WOODEN CASE WITHIN FLOWER STAND.

An examination of Fig. 56 will show that the perpendiculars or legs are turned work in quartering, but if this is thought too elaborate a simpler plan is suggested in Fig. 57. In this it will be seen that the legs are straight lengths of planking, screwed or dowelled together; if dowelled, small iron brackets should be screwed upon the inside, for the sake of strength. Into these legs, whether turned or otherwise, cross pieces are let in in the usual way, with mortise and tenon joints, but if the legs are made of strips of planking, the upper parts at the angles must be filled in to allow a strong mortise to be cut, the planking, or strips being too narrow for the purpose. Before the stand is finally fastened together, the end and side rails must be carved, moulded or inlaid, according to the character of the chest.

Care must be taken that the stand is of the same size as the chest, and that the side and end rails are fairly flush with the sides and ends of the chest. Into the upper edge of the rails of the stand, dowels should be inserted, corresponding sockets being bored in the under edges of the lower rails of the chest. This arrangement permits the chest to be removed from the stand at pleasure, without any difficulty.

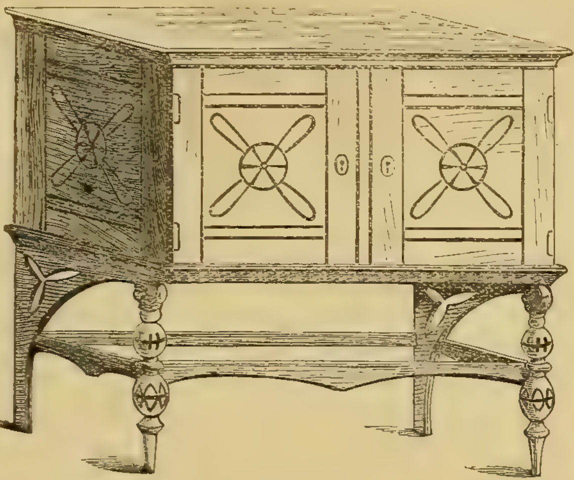


FIG. 63.—SMALL BUFFET MADE OF OLD CHEST AND SLIPS OF OAK.

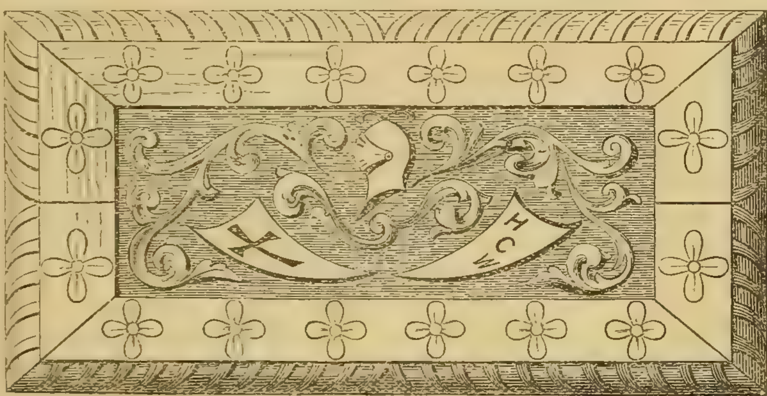


FIG. 62.—DESIGN FOR CARVED SLAB TO FORM TOP OF OAK CHEST.

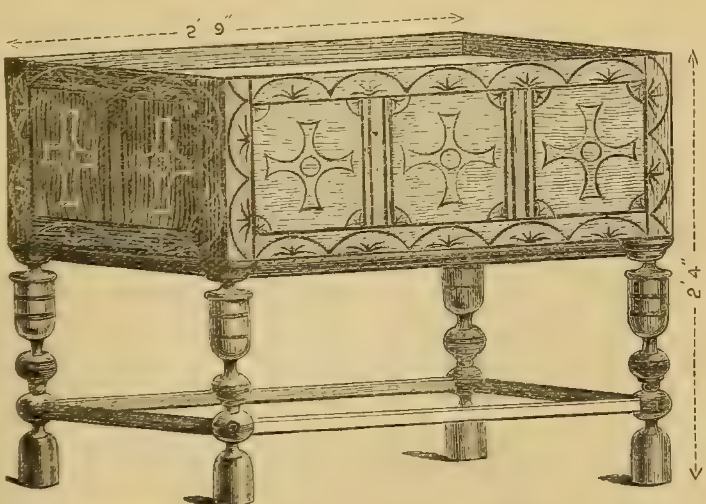


FIG. 56.—SMALL CARVED OAK CHEST ADAPTED TO FORM FLOWER STAND.

The stand being complete we may now turn our attention to the chest itself. We must first remove the lid. This operation will require care, as the long iron hinges will, as a rule, be found to be fastened on with the most irresistible of nails, the heads of which will only consent to move after much persuasion, and the tails, never; excepting to the great detriment of the oak. This done, we proceed to fill up the unsightly gap left by the removal of the huge iron lock and plate which once, probably, did good service, carving the piece inserted to match the rest of the rail. All other small repairs being also finished, we may lift the chest into its place on the stand and start upon the inner case which is to hold the flower-pots.

This, as will be seen from Fig. 58, is simply a box dropped inside the chest and supported on the inner perpendicular supports cut down for the purpose to the required distance, as shown in Fig. 59. Upon the top edges

of the sides and ends of this inner case we then screw a flange sufficiently wide to make a false top along the edges of the chest which, as it will be found, is necessary to give a finish to the edges of the inner case as well as to the chest itself. Inside this case it will be advisable to place a shallow tray of zinc, in order that the drainage from the flower pots may not soak into and spoil the case. Through each end of the inner wooden case two good-sized holes, B, B, should be bored, to enable it to be lifted without difficulty from the chest. The inner case may be made of white wood of any sort. The woodwork being complete, we proceed to rub the whole well with oil, and afterwards dry polish it with a brush.

The next use to which a moderate-sized chest can be put is in the manufacture of a sarcophagus, as it used to be called, Fig. 65. This, it need hardly be explained, was not a family tomb, although the article in question, it cannot be denied, often bore a most mournful aspect. It was only what we now call a cellaret, and stood beneath the sideboard stored with bottles and decanters.

These pieces of furniture are not very often now sold as necessary adjuncts to the sideboard—the cellaret or small buffet having superseded them and taken their place. This, however, is no reason why we should not turn a chest into one of these certainly very useful old-fashioned movable cellarets, when in their favour we have beauty, cheapness and utility combined. We must select a good chest, see Fig. 58, for our purpose. It should be rather small, and we should aim, as far as possible, at getting one of the better type, in which the designs are artistic and the workmanship and finish good. The lid should also, if possible, be panelled and in sound condition. We begin, as usual, by washing the chest, and to do this thoroughly it is very advisable to take the panelled work to pieces by knocking out the pegs in the ordinary way.

Old chests are generally full of small white lice which run in and out of the crevices with great activity. They are highly suggestive of dirt, and no amount of washing on the outside will dislodge them. These little creatures are, however, found in most old wooden furniture, and in places where the accusation of dirt cannot be brought.

In the case of our chest, however, it will be well to hunt them out. dirt or no dirt, and the only method which is likely to be successful consists in taking the chest to pieces as far as possible, scrubbing the grooves and mortises with hot water, black soap and soda, and, finally, when the wood is dry, soaking all the parts which look inclined to the attacks of dry rot with an unstinted supply of turpentine before putting it together again.

The inside of old chests always being very rough, it will be advisable to insert a lining in the one under consideration, if only for appearance' sake. This lining is simply a well-made deal box, the sides of which are tongued and glued together and dovetailed into the ends. Three-eighths inch stuff will be found sufficiently strong for the purpose—no stain being put upon this inner lining. In depth this case should be ½ inch shallower in outside measurement that the inside of the chest, to allow a fitted ½ inch oak flange to be screwed upon the upper edge of the lining or inner case, to fill up the gap between the lining and the chest.

This inner case being in place, we may proceed to fit the bottle rack. No measurements can be given for this ; individual requirements and the size of the chest alone can settle these details. Fig. 60, however, shows the general type and construction of these racks. Should, however, this rack be thought too frail, a stronger and more elaborate one can be made of zinc, or an adaptation of it, as in Fig. 61, which, it will be seen, combines a tray and rack in one. It should fit the inner case with sufficient slackness to allow of its sliding easily in and out if required. This type of rack, however, is only suitable when the front of the cellaret is made to open.

We now come to the top or lid. If the lid is panelled but plain, the appearance will be greatly improved by the addition of suitable carving, and it will be advisable to reproduce the scheme of the front rather than introduce designs which may destroy the continuity of the idea which often seems to run through the old work. Should, however, the top be a single slab, as is generally the case, a design such as given in Fig. 62 may be introduced. The shields can be left plain or arranged with their proper quarterings. The effect of this top is very good ; the drawing is from a lid actually so treated.

Of course, the old hinges must be removed, and others of a more solid kind put in their place. Those shown in Fig. 52 are good in character, and may be obtained from Mr. Cox, *Wych Street*. The back part of the hinge, however, which should be 5 inches in length, must be ordered specially, the ordinary back flap being too short for our purpose. Before fixing on the lid and hinges, for which square-headed screws should be used, all defects in the chest itself should be made good ; and it may even be needful to put in a new bottom, this part being often very rotten and broken. A strong lock will also be required ; and, finally, that the cellaret may be moved easily to and fro from underneath the sideboard, without injury to the floor and carpet, or to the contents of the bottles, castors must be fixed below the corners.

If the legs of the chest project below the bottom

they must be cut entirely away and level with the side and front rails. The castors should not project more than $\frac{1}{2}$ inch below the rails, blocks of a requisite substance being arranged as needed. The holes, B, B, in Fig. 58, afford easy means for putting in and taking out the inner case.

There are few more useful pieces of small furniture than a buffet, and one on the lines as shown in Fig. 63, is easily made out of a chest and some strips of old oak. Such a piece may be used in the dining-room, the lower part being handy for dishes, glass, etc.; while the upper part, fitted with shelves on one side and a bottle rack on the other, fills the place of a tiny sideboard, or with a different arrangement in the upper part it will be useful and ornamental in either the study or drawing-room, being well adapted for a music-stand or Canterbury, while the top and shelves below afford a good position for china, etc.

There is no necessity for any of these pieces we are describing to wear the aspect of being made up. Avoid incongruities of design and errors in mixing different styles in carving, and our old pieces will answer, and more than answer, our expectations. In the greater number of pieces of made-up oak which are offered for sale, no attempt seems to have been made to introduce any scheme of design in the carved work. The workman has evidently been supplied only with a rough outline sketch of the piece he is to make—a certain amount of old carved wood in which no two pieces are alike—and there is therefore but little wonder that the result is, at best, a higgledy-piggledy affair. A practised eye will always be able to distinguish new carving from old ; but a good copy is admissible, where old work hopelessly mixed is an offence. This buffet, or Canterbury, or cabinet, which-ever we call it, is in two parts—the top, formed out of the chest, and the lower part, or stand, which we must make for ourselves. The legs of this lower stand are, as will be seen in Fig. 63, turned work, and somewhat extensively carved. The stand must be of the same length and breadth as the chest. Supplementary strips of oak, at least 2 inches wide, should be screwed on the inside of the upper side and front rails of the stand to form a solid foundation upon which the chest may rest. The legs of the chest must be cut flush with the bottom front and side rails, to allow it to sit flat upon the stand. Dowels should be inserted in the upper rails of the stand, sockets bored to correspond in the lower rails of the chest. A moulding $1\frac{1}{2}$ inch deep should be run along the lower rail of the chest and fastened upon it, to hide the division between the chest and the stand.

From Fig. 63 it will be seen that the front of the chest is altered to form doors, a plan which is required by the necessity of gaining access to the chest from the front. This alteration is best made when the chest is taken to pieces for the purpose of cleaning, as described above. It will be seen that the front stiles and panels are entirely removed, leaving the front ready for doors. It will be necessary to fill up the grooves and mortises in the rails which carried the panels and tenons, and, for appearance' sake, all chamfers should be cut square and filled in also. Midway, between the side stiles, we now proceed to insert a division in the centre, which, at the same time, will act as a stop for the doors, and if thought well a shelf can be fixed within the chest. If it is decided to use the piece we are constructing as a buffet for the dining-room, we must fit the right-hand side with a bottle rack, which can be either fixed or made to slide. If fixed, the same system can be used as described before, see Fig. 60, otherwise a movable tray must be made as in Fig. 61.

If, however, a Canterbury is required, we must run our divisions vertically, and it will be advisable to insert a new bottom level with the rails, otherwise the manuscripts and music will be apt to drop down and cause unnecessary trouble when wanted.

We may now think about the doors, which should be made of old oak. The panel which we have already taken out of the chest front may possibly come in again, but in case they are too small, or the carving too near the edges, we must hunt out some plain panels and carve them for ourselves. A description of door making has already been given, and it is needless to repeat what was then said. Fig. 53 shows designs of hinges, the ornamental sides of which should be fixed upon the doors, and the plain side on the inside edge of the side rails. We must also remember to put a good lock upon one of the doors and a neck bolt on the edge of the other. Fig. 64 shows two designs for escutcheons which can easily be worked out of a piece of brass plate.

In making this buffet, or Canterbury, it will be necessary to select a chest with a solid lid, otherwise the top cannot be so easily or satisfactorily used as a stand for china, etc. We shall already have removed the hinges, so when we have filled up the screw-holes and planed the upper surface with a fine smoothing plane, we may proceed to fasten it in its place for good, with blocks glued on from beneath. If it is thought worth while to take the extra trouble, a shallow ogee cornice (Fig. 39) fastened between the chest and the lid will greatly add to the appearance and finish. This cornice may either be left plain or relieved with a little carving.

Before leaving the subject of old chests and their capacity for transformation, it will be well to look at Fig. 65, which shows a most massive looking and effective specimen of oak furniture. If we attempt to

copy this the centre part may be well supplied by a moderate sized chest, the front of which may either be made to drop like a bureau top or cut into doors to swing in the usual way. This piece of furniture may be said to consist of five distinct parts: the base, A; the body, B; the top, C; the back, D; and the supports or columns, E. It is useless to give measurements—as details must, of course, depend entirely upon the size of the chest—further than to say that the entire height is about 6 feet 6 inches.

In making up such a work as this it will be found advisable to provide a distinct framing upon the heads of the lower columns to carry the chest or body, the rails being moulded into a plain ogee form. If it is decided to cut the front upon the drop system, the front side rails must be cut through parallel with their width, and when properly faced, hung with hinges on the lower side to the framing already fixed on the column heads. The upper columns, as will be seen, are fixed upon the edge of the top or lid of the body, B, and support the front of the head or canopy, C; the back of the canopy resting on the handsomely panelled and carved back, D. The back legs below the body are simple strips moulded or carved. The back, D, is made in the usual way, with grooved rails and stiles to carry the panels, and should be dowelled into the lid of the body and also into the canopy, C. The columns and other details speak for themselves. Underneath is shown a fine old specimen of a deed box.

(*To be continued.*)

AN EASILY MADE FOLDING COT.

By J. L. DWYER.

IT may be useful to some of the readers of AMATEUR WORK, who are either married or about to enter into that happy state, to have a description of my folding cot, and to get directions as to its construction. There are many gentlemen, even in my own circle of acquaintance, who read or contribute to our most useful periodical, even although the care of a large household rests upon their shoulders. They find that to give it up would be to lose a dear friend who never scolds, but is always ready to give help and advice. They also find that many a shilling is saved by its means, and it is to effect this that I now submit to them this paper.

A cot has been, I believe, briefly described in a former number, but it was a swinging cot, and its manufacture would entail much more labour and expense than mine. I have a great objection to swinging cots. I think nature knows when a baby ought to sleep, and it has not provided for swinging. My wife and I have successfully reared three children, but they were never swung or rocked. Being accustomed to sleep when placed in the cot, from infancy, they soon learned not to expect more; and I have the testimony of many, that they are very quiet, and give little trouble. To return to the cot.

Figs. 1 and 2 will give a fair idea of the general appearance when open and closed respectively. When I made the first cot (for I made two) I had not a lathe to turn the standards; so I chamfered the edges nicely, as shown at Fig. 3. This will do very well, and looks almost as pretty as the turning, if done well.

The materials required will be:—eight pieces of wood, namely, four pieces 1 inch by 1 inch by $3\frac{1}{2}$ feet

FIG. 1.—FOLDING COT, OPEN.

long, four pieces 1 inch by 1 inch by 20 inches long, and a piece of $\frac{1}{4}$ inch brass tubing, $2\frac{1}{2}$ feet long.

The wood may be any sort, but I used yellow pine and found it answered, and the total cost, without the curtain, was to me about 1s. 2d. for brass and wood. The curtain we will speak of afterwards, but I may mention here that it consisted of 6 yards satinette at $4\frac{3}{4}$d., 2s. $4\frac{1}{2}$d.; 6 yards cheap cream lace at $1\frac{3}{4}$d., $10\frac{1}{2}$d; total cost, 4s. 5d., say, 4s. 6d., which I consider very little for an article which you could scarcely buy for 35s.

The wood ought first to be planed up nicely, an inch square, and then either turned or chamfered, but do not turn the whole leg. Fig. 3, will give the dimensions to which the leg is marked, namely—

A to B $\frac{1}{2}$ inch. B to C 1 inch. C to D $\frac{3}{4}$ inch.
D to M $\frac{1}{4}$ inch. M to E 17 inches. E to F $1\frac{1}{4}$ inch.
F to G $1\frac{1}{4}$ inch. G to H $14\frac{1}{2}$ inches. H to I $\frac{3}{4}$ inch.
I to K 1 inch. K to L 2 inches.

The chamfering is a $\frac{1}{4}$ inch deep. By marking lightly on both faces with a gauge and using a bull-nose plane, the chamfer can easily be done. The step at the end is as long as the bevel is deep, as seen at Fig. 4. If the bevel is to be $\frac{1}{4}$ inch deep, as in our case, the line C D should be $\frac{1}{4}$ inch from A B, the top of the step should begin at A, and the two surfaces, that of step and chamfer should meet in the line C D. It will be noticed that in all my frame, the point A is $\frac{3}{4}$ inches from a cross bar or support.

Having bevelled or turned four legs, one of the cross bars should next be bevelled, as shown, at Fig. 5 another similar, but only $14\frac{1}{2}$ inches long between tenons, should also be prepared.

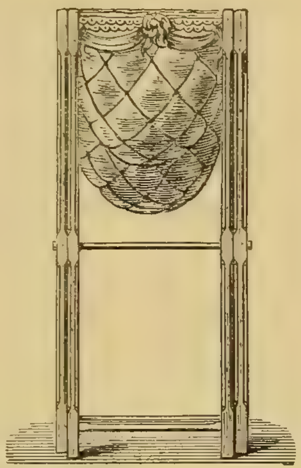


FIG. 2.—FOLDING COT, CLOSED.

The dimensions are:—From A to B, $1\frac{1}{4}$ inch; B to C, $\frac{3}{4}$ inch; C to D, 15 inches; total length between shoulders, $16\frac{1}{2}$ in. The upper cross bars need not be bevelled, but may be slightly rounded. Cut the mortises in the legs $\frac{1}{4}$ inch full wide, and the tenons to match, and put together with glue and wedges, taking care that everything is square and as nearly out of winding as possible. If anyone should fear this mortising, which is the hardest part of the work, he may halve the pieces together, as in an Oxford frame, Fig. 6, and secure with a couple of screws.

We have now two frames like Fig. 7, but one a little narrower than the other, so that it can go inside it; we have only to secure them together with two

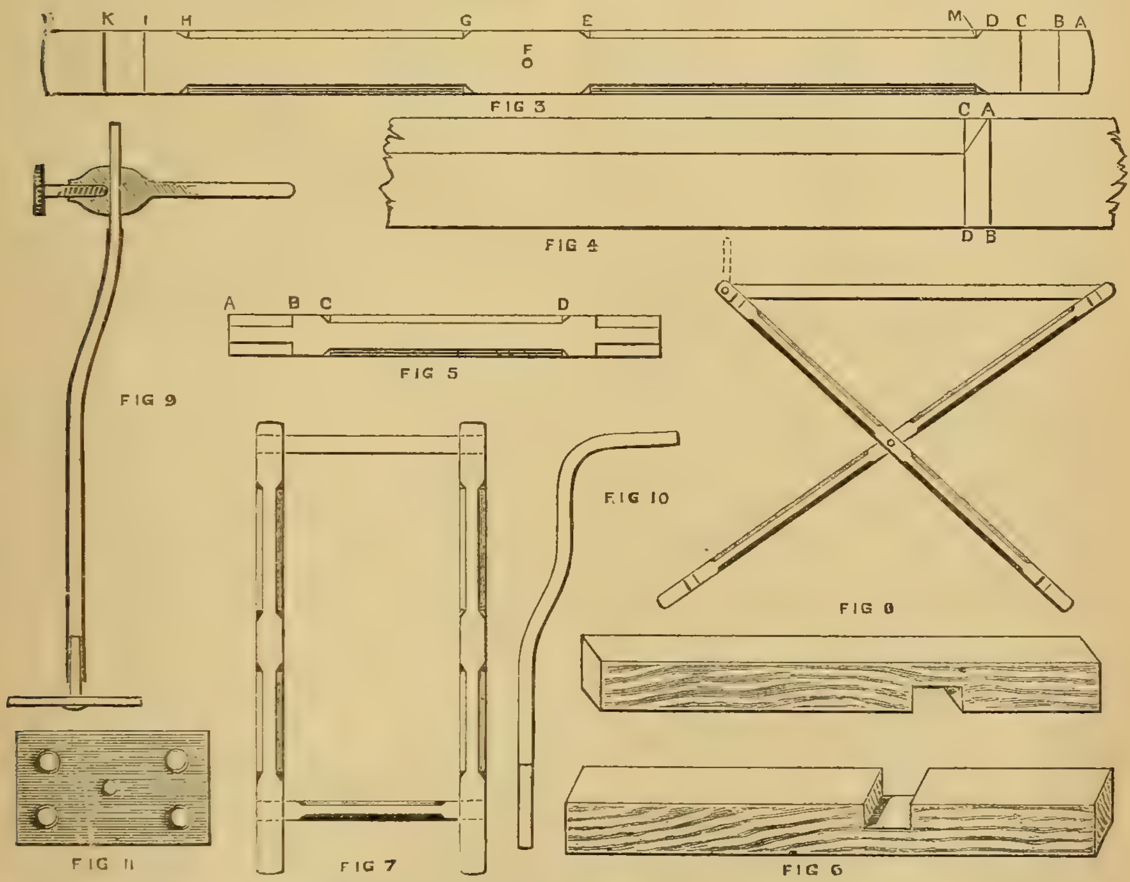


FIG. 3.—STANDARD WITH CHAMFERED EDGES. FIG. 4.—MODE OF SETTING OUT CHAMFER. FIG. 5.—CROSS BAR OR RAIL. FIG. 6.—MODE OF HALVING STANDARDS AND BARS TOGETHER. FIG. 7.—FRAME COMPLETE. FIG. 8.—FRAME WHEN SCREWED TOGETHER AND OPENED. FIG. 9.—BRASS TUBING FOR SUPPORT FOR CURTAIN. FIG. 10.—SIMPLE FORM OF BRASS SUPPORT. FIG. 11.—BRASS PLATE THROUGH WHICH PIN IS INSERTED TO CARRY SUPPORT.

screws, as in Fig. 8, and we have the frame work of our cot.

In my first, I put a bar across the top, as in Fig. 8. This bar is 30 inches long, 1 inch wide, ½ inch thick, and, if the frame work is not well made, it will strengthen it considerably, but it will preclude the possibility of the cot folding. If the latter is desirable a strong webbing should replace the wood. A piece of rather thick sheet brass should be procured 1½ inch long, ¾ wide, and holes bored as in Fig. 11. The four outside ones should be countersunk for screws, and into the inner one should be riveted a piece of iron or brass ¼ inch thick to fit the brass tube, and about 1½ inch long. The tube should then be sand-papered clean and bent into the form, Fig. 10; the height of the overhang from cot rim being about 2 feet, to the first bend about 1 foot; overhang, say 9 inches.

Fig. 9 shows a slightly more elaborate arrangement I made for my own, but it is not at all necessary to go to the trouble of doing it so well. Some would prefer to screw the tube on the plate, and I did so at first, but when it got broken I replaced it by the simple spike, and it works admirably. By slightly flatting the cross-bar at the wider end, and screwing on the plate at the middle of it, we finish our part of the business, except the painting, which is very simple. Ultramarine was the colour I chose for my first, and I lined it with amber, and varnished, but almost any colour will look well if it matches the trimmings.

The rest of the work, trimming, etc., we leave usually to our better half; and to mine I must now apply for inspiration for the remainder of the description. We used a piece of ticking, a foot larger than the space enclosed between the top rails, and tacked it all round. This was in the first cot. It thus formed a sort of bag 6 inches deep, and into this the mattress was put. Care must be taken to put the first four tacks through the centres of the edges of the ticking into the centres of the rails. Four large pleats will appear at the corners, but they can be turned down.

A flounce 2½ fingers deep, turned in to form a heading, with a quilling put over to hide the sewing, is tacked round outside the frame and hides the ticking, while the clothes and baby hide it inside. If the folding form is preferred the same plan may be adopted, but instead of tacking to the side bars, bag and flounce should be sewn.

It may appear to some that there would be a tendency in this cot, to sag in the middle, I thought so before I made it, but in practice it never occurred. The curtain is longer than that shown at Fig. 1, and is so wide that it completely envelopes the cot. It is 3 widths, rounded a little at the tail, a yard and a half long, edged with lace, quilled on to the piece of brass, and ornamented with a bunch of ribbon, blue and cream. Many of the terms employed towards the end are unintelligible to me, but I suppose everyone who uses this paper will have a wife to direct him; and if anyone contemplates making such a cot for a present, he may have a sister or a *chère amie* who will do the needful.

TAPESTRY OR TEXTILE PAINTING.

By HUGH HALFORD.

Introductory Remarks—Uses—Materials: Canvas, Colours, Brushes, etc.—Preparing the Canvas—Tracing the Design—Painting—Concluding Remarks.

By Tapestry Painting is to be understood the art of working with liquid colours on a canvas specially woven for the purpose. The process has come to us from France, it having been invented, or, as our French neighbours choose to call it, "revived," by a M. Binant some twenty-five years since. To a certain extent this art may appropriately be called a "revival," for that painted tapestries were in common use, not only on the continent, but also in this country during the fifteenth and sixteenth centuries, we have abundant evidence. Important examples of such work are still to be seen at Rheims, in, if the memory of the writer serves him rightly, the Hotel de Ville. That the process then in use had much in common with that about to be described, is, however, open to question.

The painted tapestries of former times were doubtless produced as cheap substitutes for the rich and costly woven hangings which formed the chief decoration of the dwellings of the great and wealthy; but that any attempt was made to make the substitute so close a *fac simile* of the real thing as to pass for it, does not appear. The French revivalists, however, have made it their chief aim so to imitate the works of the old schools of woven tapestries as to be indistinguishable from them. In short, they have laboured to make this process the means of producing clever and inexpensive shams.

That it should be within the scope of tapestry painting to reproduce with ease the charms of colour and old world associations of ancient tapestry is no small point in its favour. The value of having such a means at command, especially to a worker of antiquarian tastes, is undeniable. But since its introduction to this country, at a comparatively recent date, those English artists who have interested themselves in it have wished to see it used in a more independent spirit. They think it capable of pro-

ducing good decorative results apart from deception. In conversation lately with one of our best known decorators and writers on design, that gentleman observed to me that he should prefer to call the art "Textile" rather than "Tapestry" Painting, and so far as might be, to free it from that suspicion of being a sham, which at present attaches to it. The word "Tapestry," he also remarked, led many persons to suppose that this kind of painting was of use only for making hangings for would-be baronial halls and galleries, whereas it was really an art which might be applied to a hundred less pretentious and more ordinary purposes. I have availed myself of his suggestion, and used "Textile Painting" as an alternative title.

Those French writers who have set down their views on this art, and notably M. Julien Godon, whose work has been translated into English, have given much of their space to tracing the history and characteristics of the various famous schools of loom-made tapestry. This is doubtless interesting, and from the point from which they regard the subject, perhaps necessary. As the imitation of the works of these schools is not, however, our sole object, it will be unnecessary for us to do so.

Uses.—These will be found to be far more numerous than an ordinary reader would suppose at first sight, for the novice must not be misled by the word "painting." In some respects "dyeing" might be substituted with propriety. The colours used are actually dyes, which being applied by the brush, completely penetrate the substance of the canvas. They in no way interfere with its flexibility; they have no "body" to harden it, and form no skin on its surface to crack or chip off. The painted fabric may thus be applied to the same decorative purposes as ordinary woven fabrics, as, for instance, to making curtains, or to the upholstering of couches or chairs. The worker who takes up tapestry painting may or may not have ulterior views of completely hanging his walls with his own productions after the manner of the olden days; but certain it is that at the outset he must be contented with some more modest effort, and if he looks round him he will find that the minor uses of his work are legion. It may be applied to almost all those purposes of house decoration for which embroidery is used, and therefore lends itself aptly to the service of the bachelor of æsthetic tastes. It may be used for mantle-boards, as hanging drapery before empty grates, for hanging or folding screens, for panels of doors, for the front of a piano, for *portières*, or, what is more important, for a frieze to surround a room. For many uses it has a practical advantage over embroidery or rich woven fabric: it will not suffer as they do from dust and smoke, but may be scrubbed and brought to its pristine state of cleanliness when necessary. Another point in its favour is that it can be worked upon *in situ*. Embroidery as it is worked, so it must remain; but if the painted fabric is found wanting in harmony with its surroundings, or in strength of colour, nothing is simpler than to retouch it where it stands.

A use which to many persons may be of value, but which has to a great extent been overlooked, is its fitness for temporary decorations. It often happens that on the occasion of any special festivity it is found desirable to render sightly rooms or passages which, in ordinary, neither are nor need to be so. Painted hangings, on which a broad rich effect may be bestowed with little labour, will supply the want in such a case, and the tough, strong material will suffer nothing from exposure to rough usage.

For the restoration, or, more properly, for the repairing of real old tapestry which has come to hand in a dilapidated state, this process will be found of service. By it the defaced or replaced portions can be painted up till they match and complete the original work. It is the most simple method of restoring, and gives the best results as regards colour. Yet, naturally, the most important use of the art will be that with which the name seems most intimately associated. Tapestry Painting offers to the amateur of moderate artistic skill a means whereby he may supply warmth and colour to his walls by draping them with richly tinted hangings—by which he may give to his rooms an artistic character totally different to those of his neighbours—and that at a very inconsiderable outlay. If to do this is the worker's object, he will probably take one of two courses. If he is of an antiquarian turn of mind, he will wish to give to his rooms much the look of Elizabethan, or, perhaps, earlier times, and will borrow or hire old tapestry and copy it; or, failing to do this, he can procure patterns prepared on the old lines from Messrs. Howell and James, or Messrs. Lechertier, Barbe, and Co., and work from them. In short, he will simply follow the example of the French revivalists; or, secondly, he may take a more independent path. If he is simply artistic and not antiquarian, he may prefer to carry out his own ideas of design and colour, apart from old precedents.

In either case he has it in his power to produce satisfactory results; and to the amateur who makes the decoration of his house his hobby, it is worth something to be master of a resource which renders him independent of the manufacturer of paper-hangings. Most of us know what it is to be at the mercy of that gentleman. Sitting in one's easy-chair and arranging the decoration of a room, we can easily imagine the exact design and tone of the paper wanted; but if we

go to buy such a paper we are tolerably certain *not* to find it. Really satisfactory wall papers can scarcely be said to exist; yet the fault does not wholly lie with the manufacturer: he must needs provide such things as will suit an inartistic public. That amateur decorator is best off who can himself provide coverings for his walls.

Materials: Canvas.—It is to the efforts of the French revivalists to obtain such fabrics as would admit of a close imitation of the stitch of old tapestries that we owe the admirable varieties of canvas now specially woven for this work. A class of materials has been produced on which the painter finds it most delightful to manipulate, and which seem to lend themselves naturally to soft and tender gradations of shade. Their coarse grain, like the "tooth" of rough paper, gives a pleasant sense of texture whilst working, and the rougher qualities of cloth tend to produce the most velvety effects of colour.

The canvas is woven of various degrees of fineness, and of different widths. According to M. Godon the French makers produce some twenty different kinds; but what most concerns us is how it is to be got in England. Messrs. Howell, and James (of 5, 7, and 9, *Regent Street*) offer the material, of fine, medium, or coarse stitch, in 24, 40, and 82 inch widths, at from 5s. 6d. to 15s. per yard. Messrs. Lechertier, Barbe, and Co. (60, *Regent Street*) give a much longer list. They offer no less than twelve varieties. Their canvases generally are 10 feet in width and cost from 10s. to 18s. per yard run. They sell, however, narrower kinds for minor purposes at proportionate prices. Their lowest is a canvas in Gobelins stitch, a yard and half wide, 4s. per yd.

FIG. 3.—SPRIG OF OAK.

FIG. 2.—ROSE SPRAY.

FIG. 1.—CARNATION.

The nature of the work must of course rule the choice of canvas, not only as regards width, but as regards fineness also. The rougher kinds give the most velvety and beautiful effects of colour, but the finer are best suited to lines and details.

Colours.—As has already been observed, the colours used in Tapestry Painting are in a liquid state. The pigments from which they are made are, however, much the same as those which furnish ordinary water colour paints. About thirty varieties are prepared. The list given by M. Julien Godon in his work on Painted Tapestry, and those set forth by Messrs. Howell and James and Messrs. Lechertier, Barbe, and Co., are essentially the same, and differ chiefly in nomenclature. The list of Messrs. Howell and James, includes—

1. Prussian Blue.
2. French Ultramarine.
3. Turquoise Blue.
4. Emerald Green.
5. Hooker's Green.
6. Raw Sienna.
7. Light Chrome.
8. Yellow Ochre.
9. Vermilion.
10. Crimson Lake.
11. Vandyke Brown.
12. Black.
13. Indigo.
14. Cobalt.
15. Vegetal Green.
16. Golden Yellow.
17. Cadmium.
18. Pink Madder.
19. Sepia.
20. Purple.
21. Violet.
22. Carmine.
23. Deep Chrome.

24. Burnt Sienna.
25. Umber.
26. Payne's Grey.
27. Scarlet.
28. Rose Pink.
29. Red Brown.
30. Italian Earth.

These are sold ready for use at the shops named, in six-penny bottles, except carmine which, costs a shilling; also in larger quantities at proportionate prices.

The whole of these colours are not *necessary*. All the results of which tapestry painting is capable, may be produced by the judicious use and mixture, of the first named twelve, and Messrs. Howell and James sell a low-priced box containing these or equivalent colours; whilst Messrs. Lechertier, Barbe and Co.'s trial box, has no more than ten colours. Still, though it is possible to work with so small a number, it is of course a convenience, and a saving of time and trouble to have the larger assortment of tints mixed ready for use.

FIG. 5.—EXAMPLE OF MASSED FOLIAGE.

FIG. 4.—APPLE TREE.

When any work of considerable size is on hand, it is desirable to have, in addition to the small bottles for use, the larger bottles to fall back upon when needed. Store bottles should be kept well closed from the air, though it does not hurt the contents of the smaller bottles, to remain open whilst the work is going forward.

FIG 6.—IMITATION OF OLD HAND-WORKED TAPESTRY.

Necessary matters also are *Pearl-ash* (6d.), to be used in removing colour, if required; and solution of *Picric Acid* (1s.) for use in mixing.

The *Brushes* used are chiefly hard hog-hairs. These are most useful. Tapestry Painting does not merely mean laying colour upon the surface, but actually working it into the canvas. For covering backgrounds and broader spaces, large, stiff, blunt brushes, somewhat akin to those used in stencilling, are made, and sold under the name of *Tapestry* or *Scrub* brushes. The beginner might buy three or four of these of different sizes, and half-a-dozen varieties of ordinary hog-hairs; he should also have four or six medium sables for laying in lines, and for finishing.

In order that the dyes may be made to penetrate the grain of the canvas thoroughly, some pretty hard scrubbing will be needed; and it will be found that the hog-hairs will work better as they get a little worn down; to cut one of the small hog-hairs down to a stump for scrubbing-in lines may not be amiss.

These dyes stain the brushes, for which reason some workers make a point of having a different brush for each different colour. Where the most absolute purity is essential, this may be desirable, but in a general way there is no need for being so fastidious. The colours are *fast* colours and will cause little inconvenience. If an artist accustoms himself to work with only a few brushes, he can do so, though it must be admitted that work is facilitated by having a larger number. Stopping to wash a brush often means a loss of time.

The small colour bottles have wide mouths for dipping the

brush into them. This is a convenience when large spaces have to be covered with a single colour, but the practice is apt to lead to getting the colours mixed. If a brush charged with one colour is dipped into a bottle containing another, the purity of the latter will suffer, and this may lead to mischief, as the colours change somewhat in drying; and it is important that the worker should know exactly what he is using. It is better to be supplied with those small china saucers sold by colourmen, and to pour the dyes into them. The cost is trifling. A slab of ground glass or a china palette for mixing colours will also be found necessary.

Other desirable conveniences will be two or three glazed earthen pots (jam pots will do) for holding water for washing brushes, etc. It will be well that the dyes should *not* come in contact with any metal vessel. Among other minor appliances may also be named a mahl-stick and a piece or two of sponge, which will be useful for washing colours from canvas (if required), wiping brushes, etc.

Complete boxes fitted with colours and other requisites are to be had from the two Regent Street shops mentioned above, by those who care to have an outfit in a compact form, at from 10s. 6d. to 63s. per box.

Preparing the Canvas.—For small experimental pieces it may suffice to lay the canvas on a drawing-board, and fix it with drawing-pins; but this plan is not to be recommended for any work of importance. There is danger that the fluid paint, soaking through the canvas will run down the board, and make itself seen in wrong places.

The proper plan is to use a stretcher as in preparing for oil painting. The canvas should be so cut as to allow a margin of an inch or two all round the design. That it may less interfere with the work, it will be well that the inner front edge of the stretcher should be bevelled off. For the same reason the cross-pieces used to strengthen large stretchers should be so placed as not to touch the canvas.

Such cross-pieces are necessary if the work is of any considerable size, since in the wetting and drying, and consequent expanding and contracting, which go on whilst the painting is in progress, there is danger that the stretcher may be warped.

A stretcher is a simple thing to make, and many ingenious amateurs will doubtless make their own; but those who cannot do this may be able to strain the canvas when the stretcher is made. The canvas should be laid down on its face on a table, or on a clean floor; the stretcher being laid on it, the edges can be turned over and fixed with a few temporary tacks. The frame may then be raised on its edge, so that the face can be seen and the stuff more carefully adjusted. The great point in straining is to keep the strands of the canvas straight and parallel with the edges of the stretcher so far as may be possible. If they are not, the design when painted, will appear awry. The permanent tacks should be placed about 2 inches apart.

It is not, as it would be in straining for oil painting, desirable to draw the canvas absolutely tight. It therefore, should *not* be damped before it is strained. If it is too tight, not only may the shrinkage in course of work cause the stretcher to give way, but it will be found that if there is too much tension on the strands the canvas will not take the dye so well. Any slight pucker or crease which may appear, will be of no moment; it will soon vanish when the colours are applied.

Another method of stretching may be used when the piece is not too large. It is that, namely, of employing a frame of the same nature as a lady's embroidery-frame, and lacing the canvas in with a needle and twine in the same manner that she does her embroidery. One frame will thus serve for various sizes and shapes. In fixing the canvas by this means, care must be had, as before, to keep the strands as straight as possible.

Dust interferes with the proper absorption of the colours. Store canvas should therefore be kept covered from dust, or if any has reached it, it should be gently beaten out with a switch before work is begun.

Tracing the Design.—The design, whether it be a copy from old work or an original, being ready, should be traced off on stout tracing paper, and will be best transferred to the canvas by pouncing. To some readers this process may need explanation. All the lines on the tracing paper have to be pricked in little holes—the holes being sufficiently near together to give the directions of the lines. The pricker may be made by fixing a needle point in any bit of stick for a handle. There is, indeed, a "labour-saving machine" for this work—an instrument something like a spur, having a little wheel armed with points which turns at the end of a handle. This may be useful when lines are many and long, but for most purposes the simple pricker will suffice. It is, by the bye, well to hold the pricker upright, or the pounce will not go through the holes properly.

The tracing having been fixed on the canvas, it has to be pounced over. This is commonly done with some powdered charcoal tied in a bit of rag; but sometimes a dusting of some other colour may suit the work better—if white, powdered talc is preferred.

On the removal of the paper, it will be seen that the dust, passing through the holes, has left faint indications of the lines on the canvas.

Another method is by placing carbon paper under the tracing, and going over the drawing with a blunt point. This also will leave faint indications of the lines on the canvas; but for large work this is not so good a method as pouncing.

Painting.—The first thing to be done is to render the lines faintly indicated upon the canvas distinct and permanent. They must be gone over with a sable brush and colour—the colour being, of course, that which the form marked out by them is intended to be painted. In such designs as show determined outlines, as in the kind illustrated by Fig. 6, there can be no objection to marking the lines in pretty strongly, but generally it is better to keep them faint, and leave the putting in of bold outlines for one of the last operations.

The lines having been secured, any superfluous dust remaining from the pouncing may be tapped off with a switch.

Care must be taken by the novice that he does not drop spots of colour on the lower part of his canvas. Tilting the work slightly forward will be a safeguard against this.

The lines sketched in, the business of laying on the colours may be begun. They are, as has already been remarked, rather of the nature of dyes than paints, and have to be incorporated into the substance of the canvas, not merely laid on its surface. The kindly way in which the canvas receives the dye is one of the pleasing features of the process. Still, some attention is needed to see that the penetration is complete. It is to be accomplished by keeping a full brush and scrubbing in with the hard hog-hair; the tapestry or scrub brushes of suitable size are used for the broader surfaces, and for the smaller ordinary hog-hair brushes. Where any very wide space, as of background occurs, it will facilitate absorption if the ground is first gone over with plain water. Imperfect saturation with colour in any part will result in white spots, which will mar the effect of the work.

The approved plan of working is to keep everything light at first, and to work up the tones to their proper strength by giving wash after wash. Any attempt to give the full depth at a single wash is dangerous. For the first washes it is well, especially for the novice, to lower the colours freely with water. It is a simple matter to deepen a tint that is too light, but to make a dark shade lighter is in this work a difficult operation. The tapestry painter can re-wash and touch up to any extent. It is *only* by repeated washes that a powerful red is to be obtained.

As the colours dry they look much fainter than when wet, and this to an extent that may somewhat disappoint the novice. It is, however, rather a safeguard to him than a disadvantage, when the ease with which his work can be re-touched and strengthened is considered. Three or four successive washes are necessary.

There are no white pigments in tapestry painting; the native, unstained canvas represents the high lights, and from these, as in water-colour painting, the artist works upwards to his darkest tones.

A colour wrongly applied or a shade too deep may be removed or lowered, whilst fresh, by scrubbing with a hard brush and plenty of clean water; and the removal is helped by the use of pearlash. Yet to erase colour is difficult, especially if it has dried, and more especially if it has been long dry, and the painter will do better to work as if to remove colour when once applied were impossible.

One especial charm of working on tapestry lies in the subtle and beautiful gradations of colour, which are formed by the blending of one dye into another whilst wet. Such blendings will often be the result of mere accident; but if the worker has an eye for decorative effects, he will not fail to avail himself of this circumstance. Practice will soon teach him how to turn it to good account. He may, however, be warned that if he attempts to mix a dark and a light shade, he will do well to lay in the dark first. It will at once sink into the canvas, and the lighter shade when run into it will not disturb it; whereas, if the light is first applied and the dark run in, the latter will disperse itself far beyond the control of the painter. If from any reason a more showy appearance than ordinary is desired, it is possible to heighten the effect of the dyes, by touching up with oil colours on the surface; or gold may be used for the same purpose. In gilding, it is necessary to "satisfy" the canvas with copal varnish, before laying on the gold-size; and the gold leaf must be well pressed down into the grain of the material with a soft brush.

As regards subjects for tapestry painting, it may, in a general way, be said to be better suited to decorative than to pictorial results. Its strength lies in producing rich and tender effects of colour. For devices which depend for their effect upon minute work, and fine and accurate lining, the nature of the dye and the rough canvas disqualify it. A fine line is never easy in this work, and a beginner will find it difficult to draw any clear line. To the designs of the old tapestry workers, which consist mainly of broad, flat masses, it lends itself readily. If the amateur has skill in the figure, he will not find any especial difficulties in dealing with it in Tapestry Painting. Indeed, either figure, landscape, fruit, or flowers, are as capable of being worked out as are merely ornamental designs, if the painter will only bear in mind that they must be treated as decorations and not as pictures.

Without the help of colour it is difficult to illustrate the present article properly, yet the annexed sketches may be found of some use. They show some of the characteristics of old tapestry-work, and may afford hints for the guidance not only of those who wish to imitate old examples, but of textile painters generally.

Thus the carnation, Fig. 1—which is from an old wrought tapestry—shows how the designer made no attempt to give roundness to the form of the flower, but only to give the general shape in colour, aided by the relief of a dark shade against a light, or *vice versa*. Large flowers of characteristic forms like this occur in the foregrounds of many tapestries, and when so placed they are frequently treated with an exaggerated formality, as is more fully exemplified in the rose-spray, Fig. 2. The result of this is to make them stand out boldly from the picture—an effect which adds greatly to the pleasure of the spectator in looking at a large tapestry. Only well-known flowers, and such as possess distinctive forms, should be chosen for such situations.

When trees come to the front, it has been usual with the tapestry designer to make them easy to be known, not only by their leaves but by their fruits—as is shown in the oak sprig in Fig. 3. In this it will be seen, that the acorns are absurdly multiplied to prevent any possibility of mistake.

When placed somewhat further into the picture, it will be seen that trees commonly assume a rather "eclectic" form; that is to say, the designer, instead of endeavouring to represent the whole tree, as he sees it in nature, has rather chosen to indicate it by some of its marked and unmistakable characteristics. The apple-tree in Fig. 4 will serve as an illustration. The early masters of painting were much addicted to treating trees in this manner, and their practice has been elaborately defended by Mr. Ruskin. It will at least be well for the designer to bear the technical advantages of this mode of treatment in mind whilst forming his composition.

When still more remote, the foliage is massed as in Fig. 5; and this, as will be seen, is a method of representation which lends itself most happily to the brush and liquid colour. A tree in the absolute distance becomes merely a trunk clothed with a foliage, almost flat, and either shaded from or towards the centre, as a light or a dark outline may be required.

The above five illustrations are all drawn from old wrought examples; and will indicate some of the ways in which the old workers elected to conventionalize nature, for the purposes of decorative effects.

If the reader should wish to imitate the old hands worked tapestries, he will do well, if he lives near London, to visit a small room at Hampton Court, seldom thronged with sight-seers, but which he will yet have no difficulty in finding. Here the tapestry falling to pieces, shows that it was worked in hundreds of small sections, then sewn together, and the joinings hidden by broad black lines of stitching, which form the outlines of the figures and other important objects. Hence to produce a *fac simile* of this work by painting, it will be necessary to surround each figure or object with a strong black line, diminishing in breadth in proportion as the object is intended to recede into the picture. Fig. 6 illustrates this in a somewhat exaggerated manner. The beginner is not recommended to try this kind of work, owing to the difficulty of rendering such lines with the brush.

Tapestry Painting is a cleanly art, which will recommend it to some persons. What is still more in its favour is, that it is also a most simple art. It is perfectly plain and straightforward, and needs no master to teach it. To say that those who know nothing of drawing could succeed in Tapestry Painting would be absurd. Yet this may safely be asserted, that with such an amount of skill as would simply serve to make him ridiculous if he attempted to paint a picture, a person may in this work, reach satisfactory decorative results. In short, Tapestry Painting is an art which seems specially adapted for amateurs.

HOW IT WAS MANAGED.

A SERIES OF PRACTICAL HINTS, SUGGESTIONS, AND WRINKLES.

FROM AMATEURS FOR AMATEURS.

XXXVI.—AN AMATEUR'S PAINTING FRAME.

[*From* AN AMATEUR SCENE PAINTER.]

I HAVE been very much interested by the practical and exhaustive articles upon "Scene Painting for Amateurs." As an amateur, I have painted a considerable number of scenes, but not having any means of learning "dodges," I have had to invent them to overcome my difficulties. One of the most serious of these has been the want of a painting-room with "a cut" in the floor; and as it might prove useful to some amateur in similar case, I have ventured to send a sketch which illustrates my dodge for doing without it. I have always objected to working upon a plank and trestle "bridge," since the artist has to give as much attention to his personal safety as to the work in hand, and when (as frequently happened) I was without assistance, the labour involved in climbing up and down made the work a toil, rather than the pleasure it otherwise is.

The sketch given in Fig. 1 shows a painting frame, with two flat pulleys at the top corners, and a revolving bar at a height of about six feet above the floor. The cloth is nailed

to the roller and top batten, and then slung by lines tied to the batten, and passing through the pulleys at the top. The scene is pulled up until the batten rests upon the cross bar; the lines are made fast, the cloth unrolled, and the stretchers put in, the cross-bar and roller being tied together at each end (as shown) to keep them in position. After the cloth has been sized and primed, it is raised another six feet, and so on. I have named six feet as the height of the bar, because that height is as much as you can conveniently reach from the floor, and the cloths I generally have made are about fourteen feet high by twenty feet wide, the top part being concealed by the "borders." I roll about two feet upon the top batten, leaving the surface to be painted, two sections of six feet each.

FIG. 2.

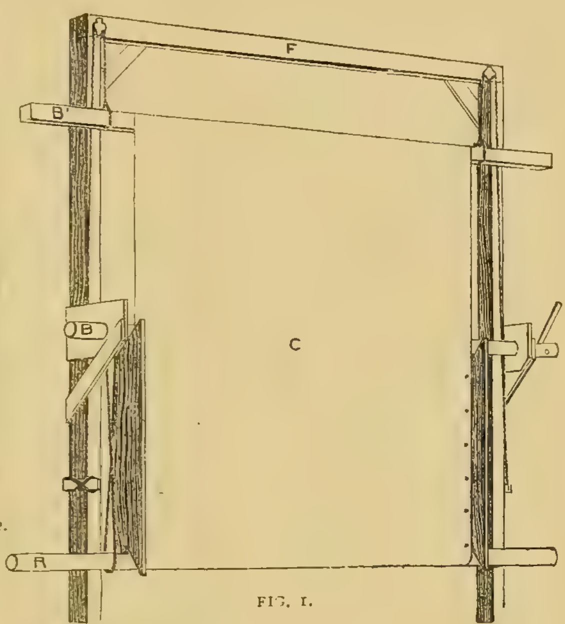


FIG. 1.

FIG. 1.—PAINTING FRAME.—B, Bar; B', Top Batten; C, Cloth; F, Frame; R, Roller; S, Stretcher. FIG. 2.—INNER SIDE OF STRETCHER.

When I have been unable to obtain sufficient height for the entire scene, I have hung it over the cross bar, working it up or down by turning the bar; the batten must be lashed to the back of the frame before the stretchers can be put in. The frame, of course, has to be cut down, according to the height at your disposal. Fig. 1, as I have said, shows the frame complete with cloth extended on it; Fig. 2 is a plan of stretcher used at sides. I need hardly say that my sketches are not drawn to scale.

XXXVII.—TURNING CRANK BEARINGS.

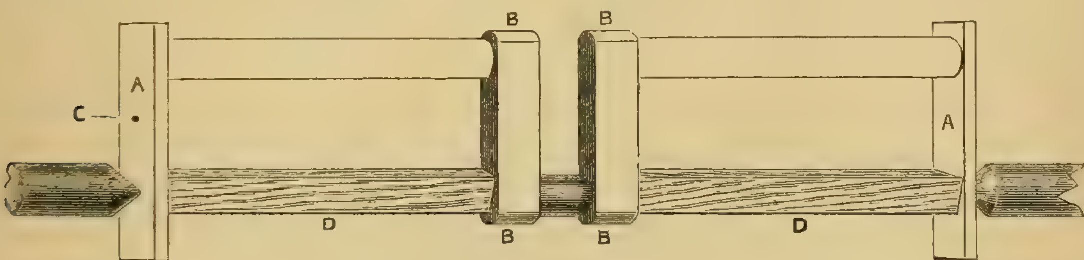
[*From W. G. SOUTHWOOD.*]

HOPING you will excuse me for troubling you with what perhaps may be as "old as Adam" to most of the mechanically-inclined readers of AMATEUR WORK, I send you a sketch of what I think may be both useful and saving to those who do not know of it In Mr. Pocock's papers on "Model Engine Making," Fig. 70, May number of this year, he says that the crank bearing should be turned between long centres, which would no doubt have to be made almost for this job alone, and this would prove rather too expensive. In my sketch I have tried to show that the ordinary centres will do just as well, if not better than long ones, as I have recently seen a crank-shaft weighing over a ton turned in almost a similar way. The pieces of iron, A A, are simply soft-soldered on to the ends of the crank-shaft, no matter how roughly, and pieces of tough wood, D D, placed between them and the part to be turned. The parts B B B B might also be turned true if desired, by altering the centres to C, and putting a piece of wood in the gap as when turning the shaft. The pieces at the ends may be easily detached by heating when done with. I hope that my effort to be useful in a small way will be as much use to others as many contributions to AMATEUR WORK have been to me, and that I am not too late in my desire to help.

XXXVIII.—AN INDIAN MODE OF REFINING SILVER.

[*From GROOVED BARREL.*]

I SEND the following description of a method used in India for refining silver, as it may be interesting and perhaps useful to some readers of AMATEUR WORK. In books I have always read that the process of refining is effected by means of acid, but I do not know how it may be done in large firms and on a large scale. I hope, likewise, that if the process is in any way novel that readers will give their opinion as to its merits or demerits. First, a crucible is made with bone charcoal mixed with cowdung (this is the objectionable part of the process), and allowed to dry. Now



CRANK CENTRED FOR TURNING.

prepare your furnace or fire with charcoal. Make a little flat to hold crucible, which, by the way, is made in exactly the same shape as a colour saucer, with a flat bottom; on the flat place in the furnace place the crucible, after first throwing in the fire a small quantity of husks (paddy husks are used here), then blow (with the mouth by the native goldsmith), but I find a hand bellows capital, blow till the silver melts. As soon as melted place a piece of lead in it, say about the size of a hazel nut for about three ounces of silver; immediately you will see the molten silver begin, as it were, running about and trembling. Now direct your draught from the bellows on to the centre of the crucible, in broken puffs, not continual, at the same time arranging your charcoal fire round your crucible in the form of a cup, rather narrower at top than bottom, and keeping all pieces of fire from off the silver. The native does this with a pair of tongs, while he blows holding an iron tube in his left hand. Continue blowing and arranging your fire till the silver gets quite hard, then at once cool the silver with water. Remove it, and break away the crucible. The silver is washed and hammered on the edges, then a thin paste is made of salt, rubbed over it, and it is again put into the fire and heated, with the salt on it, to a dull cherry red, and then plunged

TONGS FOR ARRANGING CHARCOAL ROUND CRUCIBLE.

into water. The salt removes any scum that may have settled on it; and then to test it, you file a bright spot on it, and heat it (red), and, on cooling, if it remains of a light straw colour, it is all right, but to make doubly sure, melt it in an ordinary crucible, and pour out on any thing. The silver is now fine. The more lead used the better the silver is, so an excess is not feared. The natives here are capable of blowing, melting, and refining from 15 to 20 tolas, *i.e.*, 6 ounces to half a pound, but are pretty well done up after the half pound. It seems a long and a tedious process, but I think is quite as cheap and effective as the acid process. I hope, however, I have not intruded on your time and space, and if accepted, it will prove of benefit to some of your amateur platers.

XXXIX.—A SUBSTITUTE FOR A LECLANCHE BATTERY.

[From *GEORGE EDWINSON*.]

SOME time ago I drew the attention of AMATEUR WORK readers to a new battery invented by Mr. R. Applegarth, and named by him the Corrugated Carbon Battery. At that time the battery formed part of a Patent Combined Bell and Battery, and the proprietor did not care to sell a single cell, or a battery, apart from the rest of the apparatus. I have now much pleasure in stating that single cells of this excellent battery can be procured from Messrs. Daniel Judson and Son, 77, *Southwark Street, London, S.E.*, at the low price of 2s. each. Although the former proprietor refused to sell separate batteries, he did not refuse to supply samples of the corrugated carbon in the form of battery plates, and I got some from him for a few of my readers. Only a few responded to my offer to get these samples for them, and several plates were left on my hands. One day, shortly after this happened, my electric bell failed to ring, and an examination of the battery revealed the Léclanché cells in a bad condition, necessitating a renewal of the porous cells. As it was then a matter of inconvenience to make up new cells, I cast about for a substitute to act for a few days until I could properly refit the battery, and it was then I thought it possible to use for the purpose the corrugated carbon plates in my possession. This is how it was managed: I first took the zinc rods used in the Léclanché cells, and cleaned them. Then I wrapped a piece of linen rag around each zinc rod, and secured the same with a bit of twine. I next got some cotton wadding, cut strips from it wide enough to match the length of the zinc rods, and soaked each strip in a strong solution of sal ammoniac. These strips were rolled around the rods tightly, until they assumed bundles large enough to be just conveniently grasped by the hand. My next care was to get four corrugated carbon plates to each zinc rod (one capped with lead and fitted with binding screw, the others plain), and place these around the bundle of wadding so as to bring the corners of the plates together and enclose the bundle as in a box. This was bound tightly with stout cord, and thus the edges of the plates brought into close contact.

The bundle of carbon plates, wadding, and zinc, thus prepared, was placed in an outer Léclanché cell, and this filled with a strong solution of sal ammoniac. My battery was made up of three such cells, connected together in series, and this worked the bell well. Many months have passed away since I set up this substitute, but I have not yet found time to replace the Léclanché cells; one reason being that there now exists no necessity for any other kind of battery. The only attention required from time to time has been to occasionally put some water in the cells, and once, to unpack the plates, wash them in warm water, and bind them up afresh. This form of battery is more constant than the Léclanché, less costly, and can be more easily repaired when out of order. The carbons are sold by D. Judson and Son, at prices nearly the same as plain carbons. The wadding acts as a substitute for a porous cell, and offers some resistance to the current. It may be dispensed with altogether, if desired, and the battery made up in a simple form as a series of single fluid cells, the fluid being a strong solution of sal ammoniac. It is advisable to have a large negative surface of carbon, and there is no advantage in surrounding the zinc with carbon plates. When made up with wadding superfluous fluid may be dispensed with, and thus a semi-dry portable battery secured. In the very compact portable batteries sold by Messrs. Judson the outer cells are of carbon, corrugated inside.

The name of the firm, Messrs. D. Judson and Son, *Southwark, London, E.C.*, although it must be familiar to most readers of AMATEUR WORK, may not, perhaps, be so readily recognised in connection with electrical appliances. It may, therefore, be as well to add that the new proprietors of Applegarth's Corrugated Carbon Battery are the proprietors and manufacturers of the well known Judson's Dyes, and the various forms of the "Purity" Filter, for household use, and for purifying water in cisterns.

NOTES ON NOVELTIES.

By THE EDITOR.

75. APPARATUS FOR TECHNICAL INSTRUCTION. 76. SMART'S IMPROVED GAME-TRAP. 77. THE BRITANNIA COMPANY'S NEW LATHE.

75. APPARATUS FOR TECHNICAL INSTRUCTION.—Mr. James Rigg, Engineer, 11, *Queen Victoria St., London, E.C.*, sends me his "Revised and Illustrated Catalogue of Apparatus for Technical Instruction, Mechanics and Mechanism, Building and Machine Construction, Drawing Appliances and Models, as supplied under grants by the Science and Art Department." This Catalogue has now reached its sixth edition: its title is sufficient to show its object and contents, and I can only say that for educational appliances the models enumerated in its pages are most useful and desirable in themselves. I have not seen any of the actual models, but, to judge from the prices affixed to them, they ought to be of the very best possible workmanship and materials. But when this is said it is beyond dispute that they are most costly—too costly, in fact, for general use in technical education for the artisan or for practical education for the middle classes; and I do not think that any amateur will cavil at my opinion in this matter of cost when I say that the following are the prices for five very simple objects in illustration of Practical, Plane, and Solid Geometry:—Hexagonal Pyramid, 4 inches high by 3 inches diameter, 7s. 6d.; Hexagonal Prism, 4 inches high by 2¼ inches base, 7s. 6d.; Cone, 4½ inches high by 3 inches diameter, 7s.; Cylinder, 4 inches by 2 inches diameter, 6s; Sphere, 3 inches diameter, 6s. My chief object in noticing this Catalogue, however, is to point out to amateurs in what quarter they may obtain models of almost any subject of mechanical construction; but they will find them expensive. For example, those who are interested in building construction and joints used in carpentry, may obtain for £6 a set of fifty varieties of joints in hard wood, size about ¾ inch square, as used by architects, carpenters, cabinet-makers, and others, in case complete, etc., for £5 12s. 6d—a selection of eighteen joints in hard wood, 1¾ inch square—all plates, bolts, and nuts being of brass; in hinged case. These consist of lapped and fished joints, scarfed joints, halved and dovetailed joints, notched joints, and mortised and tenoned joints. My remarks are in no way intended to depreciate Mr. Rigg's models, which, without a doubt, are as perfect as it is possible for models to be, and which are paid for by the British taxpayers at large. I write, however, in the interest of amateurs who have to provide these things for themselves and their boys, and I am sure my readers will agree with me when I say that these things ought to be obtainable in good material, and in larger sizes, at much lower rates. I believe that there are many skilled working carpenters and joiners who could make a handsome addition to their income by making and supplying those joints used in carpentry to order for the use of amateurs who wished to see any joint absolutely before them, or by starting classes in their respective localities, at which amateurs, whether men or boys, could have a little of the best of all teaching—practical experience.

76. *Smart's Improved Game-Trap.*—This merciful and humane contrivance, which is intended to catch and hold fast any animal that may put its foot in it, is similar in general principle to the old form, whose jaws are armed with serrated teeth, and whose fangs must have cruelly tortured all rabbits and rats that found themselves within its grasp, its teeth entering the flesh when the animals are retained in durance vile, or, as has often happened, entirely taking off the leg of the animal caught, and allowing it to go free minus a limb and in sickening pain. The notable improvements that have been made in this new kind of game-trap are, firstly, that the teeth have been removed, and vulcanized india-rubber substituted for them as the gripping medium; and, secondly, a regulating screw on the spring, which can be adjusted so as to allow small rabbits that would be of no value if caught to withdraw their legs and make their escape. These traps were tried last season, as an experiment, on Sir Julian Goldsmid's estates in Kent, with the best results, the game being secured in every case where the trap was sprung. The rubber facings proved very desirable, not showing the least signs of wear and tear; the grip or holding power exerted by them being very great, although incapable of lacerating and wounding. Those who wish to make trial of these traps should address their applications, "Smart's Patent, *Heathfield*, *Sussex.*" A sample trap will be forwarded for 2s., carriage paid; for a dozen the charge is 18s.; but larger quantities are supplied at a still further reduction. The small charge made in excess of the price of the old-fashioned trap will be amply repaid in only once securing the game instead of the leg and the leg only.

In naming the sizes of Smart's Propeller, in page 447, the proportions were given as "feet by inches" instead of "inches by inches." The error, which is purely clerical and accidental, must have been obvious to all readers.

77. *The Britannia Company's New Lathe.*—I mentioned this forthcoming lathe last month, and pointed out the extremely low figure—£4 4s. only—at which it is proposed to produce a machine that is no mere toy, but capable of doing good service to the owner in turning out large and substantial pieces of turned work. It will be patent to all, that in order to supply so good an article at so low a price, the Britannia Company naturally require a large sale in order to make the speculation remunerative, and are ready to receive orders in advance. Every amateur woodworker ought to have a lathe, even if he does not do very much in the way of turned work, and as the Britannia Company supply goods on the hire system—an easy system of monthly payments, I venture to suggest that those readers of AMATEUR WORK, who wish to own a good lathe, should at once make known their desire to the Company, and close with them on their own terms of easy payments. Ten shillings and sixpence a month for eight months will buy the lathe. I reiterate my advice to readers to make arrangements promptly, lest there be any advance in price, which is far from unlikely if orders fail to come in freely.

AMATEURS IN COUNCIL.

For "Instructions to Contributors and Correspondents," see page 44 of this Volume, or Part 60, page 44.

Boot and Shoe-Making.

AN ADMIRER.—I note that you write from *Northampton*, and this may account in a great measure for your expressions of dissatisfaction with Mr. A. Murray's paper on "Boots and Shoes: Cutting and Fitting," in page 433 of this Volume. You ask me not to publish your letter, and I refrain from doing so, because I can well believe that you were by no means anxious to see it in print, as it was merely written with the view of making me think I had made a mistake in publishing the article, and that the writer of the paper was far from being up to the mark. Your apology for writing at all is that you are moved with compassion for me, because not being able to understand everything, I have been imposed on, taken in, and thoroughly done for. Now it is a pity you should trouble yourself about *me*, because I am very thick-skinned, and letters such as yours cause me far more amusement than concern, tempered with regret that as your "time is too precious to criticise the paper fully," you should have wasted that valuable commodity in covering eight pages of note-paper with your strictures on the paper and its writer. The article, let me say, was written at my request to meet the desire of various correspondents, that it has been paid for, and that neither the Publishers nor myself consider that it was "rank robbery" to take anything for it. The paper was written for non-professionals; had it been intended for professional shoemakers, or for beginners intending to follow shoemaking as a trade, it would have been written in a more professional tone. The writer does not pretend that his instructions are the only way of cutting and fitting uppers: he merely gives them as a simple mode of attaining the object in view, suitable to the comprehension of amateurs, who, perhaps, would fail to understand the technicalities of the trade if entered into. You know, as well as he and I know, that if anyone follows the instructions given, he will succeed in turning out tops to his satisfaction. As to the statement that side-springs are not so much worn as they were there is no doubt whatever that laced boots for out-door wear are preferred, especially by young men, and with good reason. As to the method given by Mr. Murray of copying a pattern, which you say is "ridiculous," the better plan for you would have been—especially as you say that you "have been an admirer of AMATEUR WORK now for some years," and that from its pages you "have picked up a few wrinkles that have helped you considerably in various ways"—to have shown your brother amateurs a better way of doing this, instead of emptying the vials of your displeasure on Mr. Murray for trying to do in a simple and intelligible manner what you have refrained from doing, although, as a reader of AMATEUR WORK, you might have supposed, if you did not know it from the correspondence, that there were many amateurs to whom the information would be of service.

ERRATUM.—Mr. Murray desires to point out that in page 443, col. 2, ten lines from foot of column, the word "inches" should be struck out after "5." The insertion of the word "inches" is altogether a clerical error.

W. A. D. (*Stroud Green*).—Mr. Abel Earnshaw never completed his articles on Boot and Shoe Making, hence Chapter VIII. forms the last of the papers contributed by him, although it is followed by the notice "To be continued."

Battery to Regulate Incubator.

INCUBATOR.—As the writer of the papers on Incubators does not now correspond with AMATEUR WORK, I have been requested to answer your letter. From a perusal of it I learn that your battery runs down in a week from the time of setting up. This is a short life for a Léclanché battery, although it is a notoriously short-lived one when worked hard. I am, therefore, led to suppose that you work your battery almost continuously night and day during the week. This is probably due to a defect in the construction of the electric part of the incubator. The wires leading from the battery to the magnet, from this to the mercury regulator, and from this back to the battery, should be double cotton or silk covered and paraffined, and otherwise well insulated and separated. The smallest defect in insulation will be sufficient to maintain a closed circuit and consequent leakage of the battery, which will then be continuously at work. Another probable fault may exist in the regulator. The heating apparatus should be arranged to maintain a temperature of 98° Fahr.; it will not harm the eggs if it rises to 100° Fahr., but should not be allowed to rise above 104° Fahr. If the heating apparatus is arranged to maintain a temperature too high for the eggs, the ventilator must be kept always open, or be frequently opened, and this entails extra work for the battery. If it is necessary to make very frequent or constant calls for current from the battery, the Léclanché form should be abandoned and another form substituted. I can recommend for the purpose a battery sold by D. Judson and Son, 77, *Southwark Street, London, S.E.* A substitute can be improvised out of four corrugated carbon plates, connected together at the top, and placed in an outer Léclanché cell; in the centre of these suspend a zinc bolt or plate in a strong solution of sal-ammoniac, when you will have a clean working constant cell of equal strength to the Léclanché.—G. E.

Magic Lantern Condensers.

H. S.—The size of the disc thrown on the screen depends upon the distance the lantern is placed in front of it, so that you may get a picture 6 ft. diameter and one of 12 feet with the same condensers. 3½ inch condensers will show the ordinary 3 inch slides very well, though some people use 4 inch ones. H. S. would find a little shilling manual, "The Magic Lantern: How to Buy and How to Use It," very useful to him. It is to be obtained of any dealer in lanterns.—FAL.

Wood Carving in Irish Bog Oak.

J. H. E. (*Shepherd's Bush*).—The information you require respecting the mounting of bog oak brooches is given in the article for this month. The mounts—joint, catch and tongue—may be obtained from Messrs. Clements, Handley and Co., *St. John's Square, Clerkenwell*, or from Mr. J. W. King, 13, *St. John's Square*, who will also fit the mounts, if required. Gravers and other tools may be had from Messrs. Buck, *Holborn Viaduct, E.C.* Enquiries are being made as to where bog oak can be procured in London.—A. W.

Raggling.

J. W. A.—"Raggling" means cutting a groove *across* the grain of the wood. Perhaps you understand the word trenching, which is generally used instead; if not, look at an ordinary wardrobe which contains sliding trays. These will probably have slips running in grooves across the ends of the wardrobe, and it is to such grooves or trenches that the term raggling refers. It is a word seldom if ever used in workshops, and one which is little known, unless it be locally. It occasionally happens that even technical terms are confined to small districts, or even to particular workshops, and I imagine this to be one of them. If I am not mistaken, it is, or was, more used in Scotland than in England. A special plane is made for cutting grooves across the grain, as an ordinary plough will not suit.—D. B. A.

D. B. A. wishes to add to his previous remarks on this subject, given above, that "raggling" is a recognised word in Scotland. The plane for trenching or cross-grooving is known in Scotland as a "raglet plane."

Cremona Fiddles.

R. H. B. R. (*Chiswick*) writes:—"If your correspondent (S. M. L., *Goderich, Canada*) does not know the four letters which the late Charles Reade wrote in August, 1872, to the *Pall Mall Gazette*, dated Aug. 19, 24, 27, and 31 entitled 'Cremona Fiddles,' let me recommend him to acquaint himself with them, as besides containing most valuable recipes, they are full of interesting historical facts, set forth in the clear and charming style which distinguished their author. Should those impressions which contain the letters be unobtainable, your correspondent will find them reprinted in '*Readiana*,' or 'Comments on Current Events,' by Charles Reade, D.C.L.; published by Chatto and Windus, *Pall Mall, London*, price 2s."

Electric-Motor for Lathe.

W. H. W. (*Dover*).—You will find a paper on the mode of making a small electro-motor in Part 71 of this Magazine, the concluding part of Vol. VI. Messrs. H. and E. J. Dale, 26, *Ludgate Hill, London, E.C.*, supply electro-motors, and will give you any information respecting those that they manufacture and keep in stock. For imparting motion to a lathe you will find the "Lee-Chaster Motor," mentioned in "Notes on Novelties," page 476 of this volume (otherwise Part 69), an appliance that is both serviceable and moderate in price.

Sizes of Saucepans and Paint-Kettles.

H. J. W. (*Newport, Mon.*)—As to sizes of saucepans and paint-kettles, the following are the dimensions of six sizes of saucepans: No. 1, cut, 13 in. by 3⅜ in.; No. 2, cut, 14 in. by 5 in.; No. 3, cut, 18½ in by 5 in; No. 4, cut, 20 in. by 7 in.; No 5, cut, 22 in. by 7½ in.; No. 6, cut, 25 in. by 8½ in. The sizes of paint-kettles are as follows: 3 lbs., 15 in. by 4 in.; 4 lbs., 17½ in. by 5 in.; 5 lbs., 20 in. by 5 in; 6 lbs, 22½ in 5½ in.: 7 lbs., 25 by 6¼. A paint-kettle is made differently from any other kind of kettle or tin. The wire which is usually put at the top of can to strengthen it is in the case of paint-kettles first sunk in a creasing iron to throw it out on the opposite side; it is then knocked over the hatchet stake with about a ½ inch of the body just below it. The wired body after being knocked over the hatchet is then flattened down on the side of the can, thus bringing the wire about ½ inch from the top of the kettle, which top presents a knife-like edge, on which to clean the brushes, etc. If H. J. W. does not understand the above, I will be glad to send him a small model of a paint-kettle if he will pay the postage, or some small pieces of tin showing the above different processes in the making of paint-kettles.—SEMPER EADEM.

Cobbler's Wax.

W. A. D. (*Stroud Green*).—You ask for a recipe for making "cobbler's wax," which is now in polite parlance styled "shoemaker's wax," although it is quite as sticky under the newer term as it was under the older and more familiar name. If you will kindly refer to the Index to "Amateurs in Council," at the end of Vol. V. of this Magazine, you will find references under the head of "Shoemaker's Wax," to pages 188, 384, 432, and 569, of the volume in question, and in pages 432 and 569, recipes given for making the composition.

Dubbing.

W. A. D. (*Stroud Green*).—A dubbing for leather may be made by mixing resin, tallow, and train oil together, the proportions being ½ lb. of resin to ½ lb. of the tallow, and 1 quart of train oil. If any reader is acquainted with a better recipe he will oblige by sending it.

Makeshifts and Expedients.

W. A. D. (*Stroud Green*).—When you have leisure to make notes of the "several very neat and handy makeshifts and expedients" that you have "come across in various parts of America," I shall be glad to have them for the benefit and information of the readers of this Magazine. Your address, as given, does not appear sufficient to enable me to communicate with you direct in the matter of contributions.

Solidified Syrup in Bottles

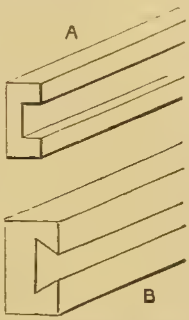
W. A. D. (*Stroud Green*) writes:—"To remove syrup solidified at the bottom of bottles, etc., fill the bottle completely with water, warm water preferable, but not absolutely essential; then plunge the bottle upside down into a dish containing water, taking care that no air is allowed to enter the bottle, and let it stand there; the sugar will then dissolve and fall downwards. Several inches of sugar may be removed thus passively in a day or so, when probably active attempts would either break the vessel or have little effect.

Moulding Composition for Electrotyping.

J. H. (*Canonbury*).—A series of papers by Mr. Charles A. Parker, entitled "Electrotyping for Amateurs," will be commenced in and form a prominent feature of Vol. VII. of this Magazine. In these papers you will find full information on the subject of moulding compositions.

Slip Dovetailing.

J. W. A.—Slip dovetailing is an expression I do not understand, but I should say it is either one of the technical terms referred to above, or that it is what is generally known as a "dovetail slide." This latter consists of a slide, such, for instance, as that on the wardrobe tray, shaped like a dovetail. The dovetail slide is often used in good extending dining-tables, instead of the plain slide. When making enquiries about out-of-the-way terms it would facilitate answers being correctly given if enquirers were to give some idea of the class of work or operation connected with the terms, for it is quite possible that in this case a rough sketch or object of the slip dovetail would have enabled me to give the ordinary workshop name to it, *i.e.*, if I am not correct in supposing a dovetail slide to be meant.—D. B. A.



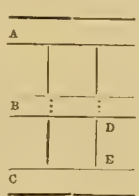
GROOVES FOR SLIDES.
A, for Plain Slide; B, for Dovetail Slide.

Trout in Aquarium.

ANGLER.—Gold fish are a species of carp, a fish that may be kept in ponds or tanks. Trout, however, are found in running streams, and if kept in confinement, so to speak, or under control, must of necessity be placed in a receptacle in which the water is subject to constant renewal by passing through it. The action of a fountain as shown in the drawing you sent would be of no utility.

Wiring Fret-cut Birdcage.

J. R. (*Burnley*).—I note that your difficulty lies in passing the wire through intervening cross-bars in the fretwork, the cross-bars being curved. Suppose, for the sake of illustration, that B is a bar intervening between the top, A, and the bottom, C, of the piece to be wired. Mark the course to be taken through B by the wire, as shown by the dotted lines in B, and perforate the wood with a red-hot needle, so as to provide a hole for the passage of the wire, or make fine saw-cuts in *the back* of the cross-bars to receive the wires, and fill up the cuts after insertion of the wires with stopping; or, make shallow holes above and below as at D and E, and after cutting the wire to the exact length, from top of upper hole to bottom of lower hole, bend the wire slightly and slip it in. The cross-pieces are curved in the pattern, and I have used straight lines in the accompanying illustration; but the mode of procedure is the same whether the bars be straight or curved.



WIRE BIRD-CAGE.

Home-Made Furniture.

IOTA sends me some good photographs of a washstand and dressing-table that he has made for his own use. To judge from these, IOTA must have attained the position of a skilled hand in cabinet work. I am sorry that I cannot, owing to the pressing demand for space, reproduce the photographs, but I daresay IOTA might be induced to send copies to any amateur who might wish to have them, and who would pay for the bare cost of production and postage.

INFORMATION SUPPLIED.

Musical Glasses.

THOMAS writes in reply to AMICUS (page 480):—"You can make a set of musical glasses in either of two ways—viz., wait until you can meet with glasses sounding the required notes, in which case no water is required; or buy as many glasses as you want notes, and get the proper notes from them by putting a little water in each, the amount of water, of course, varying with the note. In buying the glasses for the latter method, choose those that give a low note when struck, as the pitch is raised by the water, but it cannot be lowered by any means that I am acquainted with. I think the glasses which stand on a foot are better than tumblers, as they are more free to vibrate. I have never tried anything but water myself, but I should think fine sand or anything similar would do instead of water, which is very troublesome, as it dries up if left in the glasses, thus putting them out of tune. I remember seeing a set of glasses which appeared to have been painted inside from the bottom upward (varying heights, of course). This, doubtless, served the same purpose as water. You might try the experiment, using, say, Brunswick black, and putting it on a little at a time. In all cases you can play the glasses by dipping the fingers (free from grease) in water in which a little sugar or gum has been dissolved, and rubbing them round the rims of the glasses. The gum causes the fingers to "grip" the glass; without it they would most likely slide round without producing any sound."

Modelling in Clay.

S. F. is referred to the articles on "Artistic Modelling," in AMATEUR WORK, Vol. II., page 149, etc. We are not acquainted with any book in which the art is so clearly and practically dealt with.

Lake-Cremona Discoveries.

THOMAS writes in reply to S. M. L. (*Goderich, Canada*):—"The letters in the *Standard* referred to by the Editor, in page 480, are reprinted in "Musical Opinion and Music Trade Review" for April, 1887, and

are summed up by Mr. Horace Petherick (very much after the style of OLLA PODRIDA) in the May part. It seems that the manuscript discovered consisted of extracts from various well-known books on the subject of varnishes, principally of the Japan or lacquer kind, and (to quote Mr. Petherick) "so far as Pavardone (the author of the MS.) gives indication, the subject of the Cremona varnish was about as much concern to him as the mapping of the other side of the moon." "Musical Opinion" is published at 150, *Holborn Bars, London, E.C.*, price 2d. monthly.

Gongs for Hall Clocks.

IOTA writes:—"Seeing no reply to TEMPUS (page 480) to this in current (September) Part of AMATEUR WORK, and on the assumption that half a loaf is better than none, I will try and help TEMPUS to a part of information sought. He does not say what *sort* of Hall Clock he needs—gong and chimes for 'Hall Clocks' is rather vague. They range from 'My Grandfather,' in his glossy dark brown, plain or carved, or inlaid, or otherwise ornamented case, to those 'dear little carved things' from Switzerland known by the mellifluous cognomen 'Cuckoo.' Should TEMPUS be the happy possessor of a 'Grandfather'—if I read the query in page 479 aright, he is—I can render him some assistance. He will readily perceive a gong and chimes suitable for that would need some slight modification ere it could be utilised for a Cuckoo Clock. Mr. Hollanders, Chronometer Maker, *Queen Street, Portsea, Portsmouth*, has lately supplied me with a very fine-toned gong, and put a new striking arrangement to my 'Grandfather' to suit it; and, as he is not only a clock repairer, but, in my humble opinion, a first-class mechanician and horologist, I have no doubt he will be able to supply chimes to order, as well as gong. If TEMPUS will write to him, all necessary information as to probable cost of same, with necessary re-arrangement of striking motion and additional mechanism for chimes, will be readily supplied. I am unable to say whether chimes can be worked in any other way than as an integral part of the clock, but I am under the impression they could not. A friend of mine has a very beautiful and valuable old clock, which has a set of chiming bells, but I am afraid the machinery which works them could not be very well adapted to an old English eight-day. If TEMPUS will accept my advice, he won't trouble about chimes unless he is prepared to have them to the tune of say £5. But go in for a gong by all means, it will add both to the value and beauty—I was going to say utility—of the clock. I have just completed the repairing of a 'Grandfather,' in fine oak case, for which I gave a sovereign. I had the clock-face cleaned, resilvered, and relacquered by a first-rate brass-finisher, one of Mr. Hollander's gongs has taken the place of the tinkling bell on which the hours were previously struck, and am now told by a competent judge, 'I could get a lump of money for it.' Friends visiting me are usually treated to a 'strike,' and the usual exclamation is, 'Oh! how beautiful'—and so it is. 'Big Ben on a refined, but small, scale,' said one. With our kind Editor's permission, I will add a word or two about fixing 'Grandfathers' that have gongs, and, at the same time, partly answer another question from TEMPUS. First, the case must be rigid itself. The repairing must be well done, and then *must* be firmly fixed to the wall against which it is to stand. If the back is thin or decayed, don't patch it, remove it altogether, and put in a new one: this should be of well-seasoned oak ⅜ inch thick. Select place in hall where it is to stand, and fasten a piece of hard wood on wall about 5 in. wide, and 1 ft. in length, the thickness of skirting placed lengthways across case, and about 4 ft. 6 in. from floor, with nails 4 in. long. Find spaces between bricks, and a good fixing will be obtained, then fix clock-case to it with some stout screws, and, if possible, put a couple of screws through bottom part of back into skirting; it gives solidity to clock, and improves tone of gong. If TEMPUS decides to act according to my suggestion, it will give me great pleasure to afford him all the help I can. My last word is: unless TEMPUS knows something about brasswork in general, and brass-*finishing* in particular, he will put the face of his 'fine old clock' into the hands of a good tradesman, it will then be done well; if he tries to do it himself, even with the most carefully-prepared and explicit directions before him, the brazen face of his beautiful old Grandfather will be anything and everything except 'a joy for ever.'"

J. H. (*Canonbury*) writes:—"In reply to TEMPUS *re* Gongs for Hall Clocks (p. 480), I should advise him to communicate with Mr. Drury, Musical Bell Maker, 3, *Upper North Street, Caledonian Road, King's Cross.*"

INFORMATION SOUGHT.

Seltzogenes.

W. H. W. (*Dover*) writes:—"Can I have instructions how to put seltzogenes in order when they will not act—that is to say, when the water comes from them without effervescing. It is, of course, caused by escape of air; but there is no one here that can put them right, and they have to be sent to London, causing trouble and expense for, no doubt, a mere trifling disorder."

Electrical Locomotive.

J. D. writes:—"In his description of the above in Vol. IV., page 205, J. T. (*Exeter*) says, 'This is only the weaker form of engine, the stronger one having a revolving electro-magnet in place of G, which greatly increases the power.' Will J. T. kindly give a sketch, showing how the connections are made with the battery, if an electro-magnet is used? Will the 'Cabaret' battery, as described by Prof. Marissiaux in the last volume, drive?" [It is altogether a "forlorn hope" that this may meet the eye of J. T. (*Exeter*), to whom I am unable to forward J. D.'s query. Perhaps Mr. Edwinson will take it in hand.—ED.]

Punch and Judy Show.

RECHAB writes:—"I wish to make a Punch and Judy show, so as to be able to amuse a number of children during the coming winter. Can you or any of our's kindly inform me how the puppets are made and worked, as I do not exactly know." [I think you will find something that will suit your purpose better than the Punch and Judy Show in the marionnette theatre described in the papers entitled "My Marionnette Theatre: How I Made It and Worked It," in Vol. VI., pp. 103 and 155, otherwise Parts 62 and 63 of this Magazine.—ED.]

Die-Sinking.

J. W. B. (*Poplar*) wishes to know if there are any works published on the subject of die-sinking.

Bleaching Pianoforte Keys.

THOMAS writes:—"Can anyone tell me how to bleach pianoforte keys? I have an old piano in very good order with the exception of the key ivories: they have turned a very nice yellow. If they could be whitened by any means it would knock twenty years at least off the apparent age of the instrument. All the recipes I can find say 'bleach it under glass in the sun.' This is, of course, impossible in the case of pianoforte keys. Some time ago I saw in a shop some keys which had just been cleaned; a white composition of some sort had evidently been used, as it had run down on to the woodwork of the keys. Whatever it was they were a most beautiful white."

Celluloid.

A. F. C. (*Madras*) asks:—Can any of your readers give me the name and address of a dealer in celluloid, with particulars of sizes and prices? I want it for ornamental turning.

Hand Flour-Mill and Baker's Oven.

GROOVED BARREL writes:—"Will any contributor give me a plan and instructions for setting up, or rather making, a hand-power flour-mill, to grind flour very fine; also building a small baker's oven?"—[OLLA PODRIDA has the hand-mill in hand, and will, I hope, soon come to the end of the experiments he has been making on the subject, and be prepared to report the result. Like nine out of ten contributors to AMATEUR WORK, OLLA PODRIDA has much pressure put on him by the demands of his ordinary vocation, and so we must all be content to await his convenience.—ED.]

Potter's Wheel.

S. F. asks:—Where may I be able to procure a potter's wheel; or could I construct one myself?

Tuition in Potter's Art.

S. F. asks:—Is there any person who teaches, or institution where one may be taught, the potter's art?

Kiln for Pottery.

S. F. asks:—Could I construct a small kiln, and get the information from books relating to the glazes of pottery?

LETTERS RECEIVED UP TO SEP. 7.

A YOUNG BINDER (No reply received for you yet. Kindly repeat your question, and I will get it answered elsewhere); A. M.; STADT DRESDEN; S. M. L. (*Goderich, Canada*); J. E. (*Ardwick*); THOMAS; D.G.T. (*Ilminster*); W. L. (*Golborne*); Mr. G. EDWINSON; H. E. G. (*Barnsbury*); A WANDERER; R. C. H. (*St. Peter's, Kent*); R. B. (*Bedale*); H. M. H. I. M.

GENERAL SYNOPTICAL INDEX.

ANALYTICAL INDEX TO "AMATEURS IN COUNCIL."

☞ *When an Asterisk* (*) *follows the Pagination, it denotes that the Article to which reference is made is Illustrated.*

FOLDING SHEETS ISSUED WITH THIS VOLUME.